THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LI. No. 6. Whole No. 739. | NEW YORK, MONDAY, AUGUST 5, 1889. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, N.Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.00 (17 shillings—20 francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No books will be sent C. O. D.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—

Annual Meeting American Gas Light Association..... 165

EDITORIALS—

Briefly Told..... 166

Preparing for the Gathering at Baltimore—The Explosion at the Lee (Mass.) Gas Works—Mr. Douglas G. MacRae and the British Water Gas Company.

On Gas Engines, with Description of the Simplex Engine, by E. D. Debouteville—Concluded from page 140..... 167

The Science of Ventilation as Applied to the Interior of Buildings, by D. D. Hoey..... 169

The Estimation and Occurrence of Sulphur in Coal..... 171

Flexible Metallic Tubing..... 171

*The Lily Railroad Tipple..... 172

The Luminous Fountains at the Paris Exposition..... 172

An Engineer's Opportunities..... 173

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 173

Cheaper Gas for Lawrence, Mass.—Sales of Westinghouse Engines—Why the Lamp Services were Removed at Salem, Mass.—The Cartersville (Ga.) Water Works Company—Sale of the Appleton (Wis.) Plant—Improvements at Fargo, Dak.—Annual Meeting, Greenfield, Mass.—The Campbell Gas Engine—Rates for Electric Lighting at Moorestown, N. J.—Regulating Gas Rates, St. Louis, Mo.—Fouled Gas Lime as a Disinfectant—The Opposition Scheme at Elizabeth, N. J.—Proposals for Pipe Laying—The Opposition at Mobile, Ala.—Contracts for the Kerr Murray Company—Public Lighting, Milwaukee, Wis.—Death of Chas. Gould Steele—The Attitude of the Authorities Toward the Consumers Company, Toronto—And Many Other Items.

Recent Patent Issues..... 176

The Market for Gas Securities..... 177

[OFFICIAL NOTICE.]

Annual Meeting, American Gas Light Association.

LAWRENCE, MASS., July 29, 1889.

Section 12 of the Constitution is as follows:

"12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on."

To the Members of the Association: Gentlemen—The Seventeenth Annual Meeting of the Association will be held at Baltimore, Md., on Wednesday, Thursday, and Friday, Oct. 16, 17, and 18. The headquarters of the Association will be at the Carrollton Hotel, which is conducted on the American plan. The meetings of the Association will be held in the Concert Hall of the Concordia Building, on German street near Eutaw.

Members should secure rooms at the hotel by writing in advance to the proprietor. The rate will be $3 per day. Past experience should induce the members to write well in advance for hotel accommodations, and to be very explicit in stating what kinds of rooms are desired. If the members would adopt the further precaution of inclosing in their letters to the hotel proprietors a properly addressed and stamped return envelope, with a request that the writer be informed whether he can secure such accommodation as he desires, much annoyance might be prevented. In the past, members have written to the hotel selected as headquarters requesting that certain kinds of rooms be reserved for them; but the hotel people could not fill the requirements, and had booked them for rooms of a different kind, without notifying the applicant of the change. The members, presuming that silence means consent, come to the meeting expecting to find reserved for them such rooms as they had bespoken, and failing in this have been disappointed. If the members would adopt the hint already given, and request an answer to their applications, trouble on this score might be prevented. In addition to the Carrollton there are other first-class hotels to which members can go if they desire; notably, Rennert's and Mount Vernon, both of which are conducted on the European plan.

The details of the programme for the convention have not as yet been entirely determined; however, it can be stated that the convention will be entertained at dinner the second evening of the meeting, and the last day will be devoted to sightseeing. Further details will appear in due course. That we will not famish for want of mental food is evidenced by the following list of essays to be read at the convention:

"Fuel Gas," by Walton Clark.

"Gas Coals of the United States," by H. C. Adams.

"Care and Operation of Gasholders," by C. L. Rowland.

"Water Gas," by F. H. Shelton.

"Leakage and Condensation," by E. C. Jones.

"Purification of Gas from Kansas Coals," by B. E. Chollar.

"Conduct of the Electric Light Business in Connection with the Gas Industry," by W. H. Pearson.

"Advantages of Supplying a Mixture of Coal and Water Gas," by T. G. Lansden.

"Some Thoughts on Fuel Gas, Induced from Practical Experience in the Distribution of Natural Gas," by John Young.

As in years past, I would advise the members to keep these subjects in their minds; to collect such data in relation thereto as they may be able, and to come to the meeting prepared to discuss these themes.

One word as to the question-box. The Secretary frequently hears the statement that the question-box, if properly used, would be the most useful part of our meetings. If this part of the literary programme of our gatherings is not properly conducted the Secretary would be glad to receive advice from the members, and he will do his best to put into practice any suggestions which may be offered. Members have in years past been invited to send in their questions in advance, so that arrangements may be made to have some one prepared to discuss each conundrum propounded. This invitation is again renewed. I would be very glad to have questions for the box sent in as soon as possible, in order that they may be published in the official notices of the meetings—it is hardly necessary, I presume, to add that the names of the questioners will not be published.

In conclusion, I would remind those thinking of joining the Association at the coming meeting, that under the new Constitution it is necessary that all applications for membership should be in the hands of the Secretary at least ten days prior to the date of the meeting.

Let us hope that the 17th annual will far surpass its predecessors in the volume of attendance and the importance of its discussions. We have on our roll many names the owners of which seldom appear at our conventions; that the absentees thus miss many pleasant hours, and the companies they serve much useful and valuable information, will, I think, be the unanimous verdict of those who habitually attend our gatherings. Respectfully, C. J. R. Humphreys, Sec'y.

BRIEFLY TOLD.

Preparing for the Gathering at Baltimore.—The lessening of the hours of daylight has already proclaimed to the gas man that the season of his busy time approaches, and also that summer wanes; wherefore he must cease his idle wanderings (that is, the gas man who is fortunate enough to enjoy such moments of ease and content as those implied in "idle wanderings") and prepare for the stern realities and bare ruggedness of the never-ending contest of light vs. darkness. Did we need other evidence that the dull days of autumn are on the way, the official notice from Secretary Humphreys in our current issue, calling attention to the forthcoming Baltimore convention of the American Association, would furnish us ample confirmation of the fact. So here we stand on the threshold of the last in the chain of Association meetings for the current year. To begin with his reminder, we note that he gives especial prominence to the Twelfth Section of the Constitution adopted at Toronto last year; and properly so, because under its working the former practice of admission to membership has been completely changed. Hitherto an application made at almost any hour of the days in which the convention was in session, provided the application was in regular form and properly identified, was equivalent to an election. That this free and easy method permitted of abuses cannot be denied—although we are glad to say no lasting injury accrued to the Association under the rule—but now that the sub-division of the membership into classes has been wisely adopted it only remains that watchfulness on the part of those who wish to become fixtures on the rolls in either of the classes provided for shall rule, to the end that neither they nor the Association shall suffer because of the applicant's failure to note closely the directions contained in "Section Twelve." Hence we would say send in your applications to the Secretary as early as possible, and do not wait until too dangerously close to the ten-day margin. The Committee of Arrangements have with commendable celerity named the headquarters and place for meeting well in advance, and they are also to be congratulated on the excellence of the selections. The Carrollton is one of the well-known and well-liked hotels of the country, and as the American plan will undoubtedly be preferred by the majority of the delegates, those who place themselves under the care of the Carrollton's proprietor may rest assured of comfortable quarters and good fare. Those who prefer to take the chances of the European plan need have no cause for fear that comfort will not be their portion; for, apart from the houses named—Rennert's and the Mount Vernon—by the Secretary, there are several others, anyone of which will be a comfortable abiding place. While not posted as to the merits of Concordia Hall as a meeting room, it is probably safe to assume that the Committee have acted as wisely in this instance as they did in selecting the Carrollton. In any event, we can say that it is eligibly situated. It is rather a strange thing that members should have to be urged to take time by the forelock in the matter of securing proper accommodations in advance of the date at which these are to be availed of; but the fact nevertheless remains that Americans, great travelers as the majority of them generally are, are apt to take too much for granted—hence, perhaps, their propensity for railing at hotel accommodations in general, when the paucity thereof that is encountered by them is usually traceable to their own—absent-mindedness, shall we say? Accordingly we would say, do not forget the Secretary's hint about an explicit understanding as to the nature and location of the rooms desired, and in forwarding their requests to accompany the same with "a properly addressed and stamped envelope." Trifles like the latter are very often conducive to surety and safety. The paper list, even at this early day, may be said to be simply grand in promise, and, from the names of the contributors, it is also certain that the promises of heated August are to be redeemed in the cool of October. The themes chosen are in many instances well outside the beaten track, although we would not wish it to be inferred from the latter expression that we thought any of the roads that traverse the field of gas literature was as yet so greatly solidified that it could not be overturned with profit. The Secretary's remarks anent the Question-Box are at once pertinent and suggestive, and it would seem to us that the complainants might do much towards rectifying the defect pointed out if they would but assist in causing the aforesaid receptacle to contain queries that emanated from themselves. In concluding our current reference to Secretary Humphrey's admirable circular we must join with him in the remark that the members who fail to attend the gatherings, not only of the American but also the other associations, "miss many pleasant hours, and the Companies they serve" lose the benefit of "much useful and valuable information."

The Explosion at the Lee (Mass.) Gas Works.—At about 9 o'clock, P. M., of the 23d ult., the plant of the Lee Gas Company was badly wrecked by an explosion, and as the reports published by the *Associated Press* concerning the affair were somewhat mystifying, we applied to Mr. W. L. Dresser, General Manager of the Company, for an account of the happening. That gentleman, writing under date of July 30, very courteously replied in the following terms: "In reply to yours, would say that our holder was in a brick building. No gas was generated after 2 P. M. of the day of the accident, and the explosion occurred at 9 P. M. When the retorts were stopped we had a seal of 8 inches, and made pressure $\frac{1}{10}$, as we were changing size of lava tips through the town. At 6.30 we gave holder another tenth, seal still at 8 inches. At 9 o'clock holder had gone down sufficiently to make our seal 24 inches. The holder was suspended by three wire cables, passing over pulleys set on 8-inch by 10-inch timbers, all coming into a common cross-bar, beneath which were movable counter-weights, and one permanent bed counter-weight, on one side of the holder. At 9 o'clock, upon removing one small counter-weight (about 50 lbs.), holder commenced to careen, as if one cable had become taut and wedged, holding its section stiff, which destroyed all balance or poise—the other two, of course, being free to move. The space between tank and pit was never such as good engineering practice, or even ordinary judgment, would sanction. It proved great enough to allow tank to tip, and far enough to clear the water on one side, with 24 inches of tank in water. At this juncture Mr. Todd and myself ran for our lives; and none too soon. Some jets close by were alight, and the gas, or the mixture of air and gas, caught at one of these, and an explosion, of course, was the result. This is about as far as our knowledge of the cause extends."

Mr. Douglas G. MacRae, who is said to be the editor of the London *Financial Times*, has been on a lengthy tour through the Northwest, his visit to the country being in the interests of an English syndicate that desired to secure control of the chief grain elevator systems of Minnesota, etc. It appears that, having been measurably successful in the object of his visit, and while on his way home, rested for a few days in Chicago, where, being seized upon by the insinuating newspaper interviewer, he revealed the fact that he was largely interested in the British Water Gas Company, the £5 shares in which he exultantly explained were selling at £25. Other information that he imparted was to the effect that his Company controlled 140 patents connected with gas making, and followed that up by remarking that "they" (the Company) "do not manufacture gas, their *business being only to sell* their patents and to manufacture and sell the machinery which is used in the process." Mr. MacRae, perhaps, would like to trade the right to manufacture, in this country, gas under the patents of the British Water Gas Company, in exchange for elevators, flour mills and other solid American enterprises. In fact, we are quite sure that he would.

Mr. Eugene H. Yorke is meeting with pronounced success in his management of the Brockton (Mass.) gas works. Brockton's growth is more of the nature of that which attaches to situations in the West and Southwest, as will be understood when it is remarked that last year 500 new buildings were constructed in the place. Lessee Peters ought to be satisfied with the situation.

(Concluded from page 140.)

On Gas Engines, with Description of the Simplex Engine.

[A paper read before the Institution of Civil Engineers, by Edward Delamare-Debouteville, Rouen, France.]

The Simplex engine, invented by the author and Mr. Leon Melandin, was brought out in 1884. It is on the four-cycle plan of Beau de Rochas, and as its main features are very much the same as the motor described by that inventor, no general description need be given, but it will be sufficient to examine in detail the various novelties and improvements which it offers, as compared with its predecessors, under the various heads of ignition, mixing of gases, governors, starting, working with petroleum vapor, and with gas of poor quality.

Ignition.—During the preliminary studies and trials undertaken to determine the general arrangement of the projected new motor, practical experiments were made on all the known systems of ignition, and the conclusion was soon formed that the electric spark was the only satisfactory and economical method. But as none of the previous arrangements had given thoroughly successful results, the idea was formed of substituting for a single electric spark, produced by contact at a given moment, an uninterrupted stream of sparks, forming practically one continuous spark, produced in the thickness of the slide itself. The great advantage of this arrangement was that the moment of ignition was determined by the edges of the ports; and at first it appeared strange that this device had not been hit upon by previous inventors; but when the practical difficulties of carrying out the new scheme were encountered, this was no longer a subject for wonder. It was found in practice that though the ignition from the sparks between the platinum points was controlled regularly enough so long as the slide was pressed tightly to the face, yet as soon as, from one cause or another, the compression inside forced the sliding surfaces apart, the inflammable mixture found its way to the spark prematurely, and the action of the crank was liable to be reversed. This fault was overcome by placing the porcelain insulator in the cover, which made it impossible for the explosive mixture to reach the sparks before the slide had fairly opened communication with the combustion chamber.

One more practical detail still remained to be achieved, namely, after each ignition to clear the oblique opening in the valve and the combustion chamber of the burnt gases, which would otherwise have combined with the fresh charge of explosive mixture, and impaired its deflagration. This difficulty was got over by forming a square hole between the combustion chamber and the slide face, so as to coincide with a horizontal groove in the slide, and thus at the proper moment open up communication with the outer air. This is what happens: At the moment fixed for ignition, that is to say, when the oblique passage in the slide and the admission port of the cylinder come edge and edge, the compressed mixture drives out the burnt gases by the small hole in the combustion chamber, and is at the same instant ignited by the continuous stream of sparks between the platinum points. The time occupied by this expulsion is about $\frac{1}{150}$ of a second, but owing to the high compression of the explosive mixture, and its consequent velocity of flow, the clearance is perfect, and the instant of ignition mathematically punctual. The advantages of this new mode of ignition are considerable; the slide, which in other gas engines is the part of greatest nicety, becomes as simple as that of a steam engine, being merely a cast-iron plate in one piece without any loose parts, pierced with two holes, one for the admission of the mixture, the other for its ignition. Its maintenance is easy and cheap, and with ordinary attention it will work for more than a year without any repairs. This is a great improvement over the equilibrium and flame-carrying slides which require to be frequently faced up.

By getting rid of this conveyed flame and of the gas burner, a considerable reduction is effected in the temperature of the valve chest, lubrication is facilitated, and incrustation is done away with. The high igniting power of the spark allows of a much higher initial compression of the explosive mixture, with a corresponding economy in consumption of gas. This certainty of ignition and high igniting power have been of the greatest advantage in the application of the plan to poor gases. Particulars are hereafter given of some of the trials made with the Simplex engine, from which an idea can be formed of its economical advantages.

Gas Mixing.—The air and gas are mixed, not in the slide, as in the case with the Otto and other motors, but in an external receptacle fixed on the cover of the slide, the air entering from one side, and the gas from the other, through a valve. After meeting and mixing they are violently sucked in by the action of the slide through a channel at first circular, then conical, then rectangular, and are thus intimately combined into a homogeneous mixture. There is nothing particularly original about this arrangement; but it is simple, and the experience of more than four years has shown that it is completely successful.

Governors.—The two methods of regulating the speed adopted in previous motors were: (1) entire admission or none—that is to say, the supply of gas was totally cut off for one or more strokes whenever any increase of speed occurred; and (2) proportional admission—that is to say, more or less gas, forming a more or less powerful explosive mixture, was admitted accordingly as the engine ran slower or faster. The second method at first sight appears the more rational, but entails certain inconveniences which have led to its rejection. The stronger or weaker mixture resulting from a proportional admission of gas is liable to become non-explosive, at one time because it is too rich, at another time because it is too poor. In either case no ignition takes place, and a charge of gas is expended to no purpose, and under certain conditions this waste may amount to a considerable proportion of the total consumption. For this reason some different arrangement, based on the principle of entire admission or none, was sought for.

Air Governor.—This consists of a pump barrel mounted on the slide, and moving to and fro with it; in this barrel is a piston made perfectly tight by packing rings. The rod of this piston is attached to the cover of the slide, and consequently holds the piston stationary; it is fixed to the piston by means of two indiarubber washers, which allow of a slight oblique motion to compensate for the movement of the cover against the slide. At the end of this pump barrel is mounted a micrometer screw with a conical point, which affords the means of throttling, in a greater or less degree, the square hole communicating with the outer air. Near this end of the air pump, on its side and at right angles to it, is placed another little cylinder communicating with it at its lower end. In this second cylinder moves freely a small piston, the rod of which carries at its end a steel knife-edge. Between this knife-edge and the piston is a spring tending to keep the piston down on its seat; this piston is moved up and down by means of a semi-circular nut. The outer end of the knife-edge controls the valve for admitting the gas, when the small piston is down on its seat.

The action of this governor is as follows: If the engine is running at, say, 200 revolutions, the slide will be driven at a speed of 100 revolutions, and the large air pump will suck and force 100 cylinderfuls of air through the square hole at its extremity. Supposing that the micrometer screw is adjusted so as to allow only the 100 cylinderfuls of air to escape through the annular space partially closed by its conical point, then so long as the normal speed of 200 revolutions is not exceeded, the small piston will remain on its seat, and the knife-edge will encounter the gas admission valve and open it at each stroke to form the explosive mixture. If from any accidental cause the speed of the engine is increased, and the slide makes, say, 101 strokes, the piston of the air pump will suck and force an extra cylinderful of air, and as this cannot escape by the square hole, it will raise the small piston and its knife-edge, so as to miss the gas valve and fail to open it. No explosive mixture being formed, there will be a miss-fire, and the speed of the engine will be reduced. This governor is very sensitive, and will be very applicable to any future adaptations of the gas engine to boats or locomotives, as it will work equally well in any position, independent of level.

Pendulum Governor.—For stationary engines another form of governor is recommended, as it is cheaper, and not liable to damage. This governor is based on the principle of the pendulum, but the method of its application is new, the essential novelty being that the pivot of the pendulum is absolutely fixed, and that the pendulum itself falls by its own weight alone, so that the time of its fall is invariably the same. It is composed of two weights fixed on a rod, in the middle of which is a pivot. This pivot is carried in a bearing fixed on the cover of the slide. The heavier weight, of lenticular form, is naturally placed at the bottom. The lighter weight, which is above the bearing, is of spherical form, adjustable by means of two nuts threaded on the upper part of the stem. By raising or lowering this smaller weight, the lenticular weight, at the bottom of which is fixed a steel arm provided with a notch, is balanced to a greater or less extent. On the slide is fixed a stem carrying an oscillating frame with two knife edges, one of which at a given moment encounters and opens the gas valve, while the other and smaller knife-edge engages with the notch of the lenticular weight. Besides being heavier, the larger knife edge is furnished with a spring, tending to cause the frame to swing below the stem of the gas valve, which it only opens when the frame is brought into a horizontal position.

The action of this arrangment is as follows: Supposing the normal speed of the slide to be 100 strokes per minute, the spherical weight must be so adjusted as only partially to balance the lenticular weight, so that its rate of fall may synchronize with that speed. At the moment of the back stroke of the slide, the small knife-edge engages with the notch of

the pendulum. Then the slide makes its forward stroke, and the notch being still in gear brings the pendulum to bear with all its weight against the small knife-edge, the swing-frame oscillates, and becomes horizontal. The larger knife-edge encounters the gas valve and opens it, and the explosive mixture is formed. Should the slide travel at a slightly accelerated speed, it will return in a shorter time than before; the small knife-edge will miss the notch, as the pendulum will fall in the same time as before, and its weight will not bear on the swing-frame, which will remain in an oblique position and fail to open the gas valve; no explosive mixture will be formed, and the engine will slow down to its normal speed. It is evident that this governor is a very sensitive one, as the knife-edge and notch will hit or miss according to the fall of the pendulum, which must occur always in exactly the same time. There is no wear of parts, and the speed is regulated by simply adjusting the upper or spherical weight, which can be done while the engine is running.

Various Modes of Starting.—For engines of small size, not exceeding 10-horse power, starting is a very easy matter; a turn of the fly-wheel draws a charge of the explosive mixture into the cylinder and compresses it, ignition takes place, and the engine starts at once. This statement refers, of course, to the Simplex type of engine, in which ignition is effected as easily at a slow as at a high speed; but with other types starting is a much more difficult matter. Up to 10-horse power one man can turn the fly-wheel and produce compression; beyond that size, and in proportion as the engines become larger, the number of men becomes a serious consideration, and for many years inventors have taxed their brains to discover some handy method of starting. A few of the more important of these schemes may be mentioned, but no good purpose would be served by describing them all.

The simplest of these plans was to store up in a separate receiver, during the time that the engine was running, a sufficient charge of explosive mixture, which, when ignited at the proper moment, would serve to start the engine. This plan, unfortunately, was open to two grave objections; the tightness of the retaining valves could not be ensured, and after a certain time the gas lost its pressure. There was, besides, the risk of serious accidents from the bursting of the vessel containing the explosive mixture, and the danger from this cause led to the discontinuance of the plan.

Other makers employed the pressure of the exhaust gases. This obviated the danger of bursting the vessels, but the leakage of the valves still remained, and it often happened that just when it was wanted there was no pressure left in the cylinder, and starting was impossible. Compressed air, springs, and other devices of a more or less practical nature were tried and abandoned, and a small auxiliary motor was at length adopted as the only reliable plan. This system is incontestably effective, but it is expensive, and for engines of any considerable size it costs as much as a small additional engine, besides the singularity of employing one engine to start another. With engines of still greater power the auxiliary engine itself becomes so large as to need a smaller one to start it; so that the whole system would be strongly suggestive of a show card of various sizes of engines.

It is only recently, and after protracted research, that a satisfactory method of starting has been worked out; and it is the special method of ignition employed which has rendered its adoption easy, and its operation certain. The arrangement for engines of 20-horse power and under will first be described, and its increased simplicity for engines of larger power will then be pointed out.

For an engine of 16-horse power, for example, a small gas pipe furnished with a three-way cock is fitted on the igniting apparatus; an admission passage for gas traverses the barrel, and a small hole of suitable section communicating with the outer air is pierced in this passage. An indiarubber tube connects this gas pipe with the gas supply of the engine, and at the point of junction is fixed a small graduated cock (which may be called the gas cock), the degree of opening of which regulates the proportions of the explosive mixture. The method of starting is as follows: The engine must previously have been stopped at the ignition point, which is easily done by means of the three-way cock. The induction coil is fitted with a contact breaker which interrupts the flow of sparks between the platinum points. When this is done the three-way cock is first opened, and then the gas cock to the marked position. The fly-wheel is slowly turned to draw in the explosive mixture, which enters the cylinder through the seating of the porcelain stop. When the piston has made two-thirds of its stroke, the three-way cock and gas cock are closed. Then the plug of the large gas cock used when the engine is running is turned, and set at the position convenient for starting. The fly-wheel is turned backwards to compress the charge, the current switched on, the spark produced, the charge ignited, and the fly-wheel receives an impetus sufficient to start it. For motors of 20-horse power and under, it is necessary to compress the charge slightly (as just described), because the passive resistances are proportionately great; but with larger engines this is not necessary, and the operation is as follows:

A small pet-cock is fixed on the cylinder above the compression chamber, forming a communication between its interior and the outer air. The engine must be stopped, not at the point of ignition, but somewhat in advance, with the crank at an angle of 90°, which, as before described, is easily done by means of the three-way cock. The piston has then made about half its stroke; the gas cock is opened to the marked position as before, as is also the three-way cock. As the gas is under slight pressure, it enters the cylinder through the seating, and draws in air with it by the small oblique hole. The explosive mixture thus formed gradually fills the space behind the piston, expelling the burnt gas by the cock at the top of the cylinder, which must be opened previously to that for the admission of the gas In about a minute (for a 50-horse power engine) the cylinder is full of explosive gas, and the cock above the cylinder, the gas cock, and the three-way cock, are then closed. As before, the large gas cock is opened to the starting position, the current switched on, the charge ignited, and sufficient impetus given to the fly-wheel to start the engine. By this method the large engines which have now been at work more than a year are started with the greatest ease.

Working with Petroleum Vapor.—In France, where the duty on petroleum and its products is very heavy, its application to gas engines is and must be very limited; but in the provinces and in districts where there are no gas works, a motive power certain in action and easy of application is a matter of considerable importance. An attempt was therefore made to improve on previous applications of this source of power, and in the last combination this attempt has been successful.

Previous methods, as is well known, consisted in passing air through or over volatile liquids, the surfaces of contact being increased in several different ways. The petroleum was allowed to percolate through porous substances, or was agitated by vanes to facilitate evaporation. These methods involved the following inconveniences: The liquids which were used, of very low density—from 0.650 to 0.700—were composed of various elements of different densities, and the air which passed over them was at first carbureted by taking up the more volatile constituents, until the liquid increased in density, and the constituents become more and more difficult of evaporation, until at last a useless residuum was left, which had to be thrown away. The engine, which worked well at first, gradually slowed down, until it ceased to develop any motive power. In addition, the intense cold caused by the evaporation reduced the liquid to a condition unfavorable to the saturation of the air. This difficulty was surmounted by applying heat, either to the air before its introduction, or to the liquid itself; but the gradual impoverishment of the liquid still remained.

Another very serious defect accompanied all the systems employed. During the distillation of the petroleum to obtain the light essences, a certain proportion of organic and mineral substances was carried over by the vapors given off, and these again were taken up in an impalpable form by the air during its contact with the liquid, and when subjected to the high temperatures produced in the slide and cylinder formed a thick crust, which after a few days not only necessitated a thorough cleaning out, but also affected the moment of ignition by clogging the edges of the ports. This, of course, refers to the slide; but the result was equally objectionable whether the above named process was adopted, or whether the liquid was directly introduced into the cylinder by spray or injection pumps; a rapid incrustation resulted in either case.

Carburetor.—To get rid of these defects the following arrangement was adopted. A receiver containing products of low density is placed immediately above a spiral horsehair brush fixed in a jacketed chamber heated by the hot water from the motor, which neutralizes the refrigeration due to evaporation. Below this receiver is fixed a cock with a graduated disc, by which the supply of the liquid is regulated according to the consumption of the engine. Close to this is another cock, admitting the hot water coming from the cooling jacket of the engine, and this water, at a temperature of about 50° C. (122° F.), mixes intimately with the petroleum vapor, which it carries along with it in its fall on to the brush, and by the time that it reaches the lower receiver the complete evaporation of the light essence has been effected. A safety valve through which the gas is admitted to the motor obviates any backward ignition. It might be thought that the water would absorb a part of the light essence, and so cause a considerable loss; but this is not the case, and experience shows that the whole of the carbureted vapor is volatilized. The only constituents absorbed by the water are the mineral and vegetable substances before named, and all incrustation from this cause is completely prevented. After several months'

working the engine is in as good condition as on the first day. Moreover, there is no fear of the gradual impoverishment of the liquid, as the whole of the volatile constituents are evaporated from each part as it flows through, so that the working is always regular from beginning to end, and the power given off is always the same.

Engine Trials.—The Simplex engine has been tested with the following gases: Coal gas, Dowson gas, gas from the Lencauchez generators, petroleum vapor, wood gas; and with all of them it works equally well. In spite of the high initial pressure to which the explosive mixture is subjected, the working is always easy and noiseless. This result is attained by determining the point of ignition not at the dead point, as proposed by Beau de Rochas, but somewhat later, when the piston has already made part of its forward stroke. At first sight it might be supposed that this would entail a loss of power, but experience shows that though the area of the diagram is diminished, the power registered by the friction brake is greater. Starting is also made easier by this method of working.

The application of gas engines for driving dynamos has often led to fallacious results, and so far cannot be said to have been a success. It must be acknowledged that in most installations, especially those on the incandescent systems, to which it has been applied, the light has not been steady, but subject to fluctuations disagreeable and trying to the eyesight. On this account the use of gas engines for lighting purposes has been very restricted, although from the nature of things there should be a large field for their employment in that direction. It has been sought to remedy this defect by employing a double cylinder engine and a counter shaft, with fly-wheels on both countershaft and dynamo. The evil is thus diminished, but at the needless expense of higher first cost, increased space required, and a more complicated engine, as a better result may be obtained by simpler and cheaper means. Several months' experience at Mr. T. Powell's works in Rouen shows conclusively that a gas engine with a single cylinder driving directly on to a dynamo placed as close as possible to the fly-wheel gives a better result than the complicated arrangement above described.

This statement can easily be practically demonstrated. All that is required is, first to drive a dynamo in close proximity, trusting to the normal slip of the belt to minimise the fluctuations of speed, and then to drive it at considerable distance. A marked advantage, which may easily be explained, will be found to result from the first plan. With short belts the shock of the exploston is not communicated to the dynamo; but on the other hand, by driving at a long distance the shock increases the whipping of the belt and transmits an amplified blow to the dynamo. Some persons urge the objection that the slip of the belt under the first-named conditions causes a loss of power; but this does not seem to be the case, as the number of lamps lighted per h.p. per hour is the same at a short as at a long distance, as has been confirmed by experience. But even admitting that there is a slight waste of power, the loss is certainly less than that resulting from the use of a countershaft, which, as demonstrated by recent experiments in the United States, may amount in some cases to as much as 20 per cent. of the power transmitted.

Tests of Consumption.—Trials were carried out on Nov. 7 and 8, 1885, by Dr. Aime Witz, of Lille. Leading dimensions of the engine: Diameter of cylinder, 7¾ in.; stroke, 15¾ in.; speed, 160 revolutions per minute. The effective work given off by the motor was measured by a Prony brake, the arrangement being that adopted by Messrs. Steward and Brooks. The ordinary lighting gas used contained about 5,400 calories per cubic meter (about 600 heat units per cubic foot), at constant volume; the Dowson gas, comparatively rich in carbonic oxide, about one-fourth of that quantity. Mean pressure of the town gas, 20 milimeters (¾ in.) of water; of the Dowson gas, 55 milimeters (2⅛ in.).

(Nov. 7, 1885.) Duration of trial, 1 hour; effective horse power, 6.70; consumption of town gas per effective horse power per hour, 22.09 cubic feet; reduced to 0° C. and 760 mm. barometer, or 32° F. and 30 in. barometer, consumption 21.55 cubic feet; water per effective horse power per hour, 5.47 gals.; temperature, entering, 51°, effluent, 135° F. Duration of trial, 2 hours; effective horse power, 8.67; consumption, 20.66 and 20.12 cubic feet; water per effective horse power per hour, 4.44 gals.; temperatures, 51° and 144° F. Duration of trial, 1 hour; horse power, 9.28; consumption, 21.23 and 20.73 cubic feet; water, 4.38 gals.; temperatures, 50° and 172° F.

(Nov. 8, 1885.) Dowson gas. Duration of trial, 2 hours; horse power, 7.12; consumption, 89.97 and 88.03 cubic feet; water, 5.83 gals.; temperatures, 48° and 144° F. Duration of trial, 30 minutes; horse power, 3.61; consumption, 188.14 and 114.85 cubic feet. Duration of trial, 30 minutes; horse power, 5.26; consumption, 100.71 and 97.88 cubic feet; consumption of oil (Moehring), 5.68 oz. per hour.

Other trials of the Simplex motor have given the following results. A 50 h.p. engine, working with a load of 35 to 40 effective h.p., consumes daily, with a Dowson generator rather underpowered, 51 pounds of English anthracite coal per hour, equivalent to a consumption of from 1.148 to 1.30 pounds per effective h.p. per hour, inclusive of everything. A 16 h.p. engine, supplied with coal gas and working with a load of 12 effective h.p., uses 2,327 cubic feet per day of ten hours, or 19.4 cubic feet per effective h.p. per hour. These two engines are in constant work, and their consumption is calculated from the daily records kept for several months, and not from experiments.

From the low consumption obtained by the use of poor gases a considerable development of the manufacture of large gas engines may safely be predicted; for their consumption is more economical than that of the best steam engines. This has now been conclusively proved.

In the foregoing rapid sketch engines of types other than those of Lenoir and Beau de Rochas have been passed over, since the principles of their construction were not those from which the Simplex engine has been evolved. A more complete description of those principles would have required a whole treatise, and would have been beyond the scope of the present paper. Those who desire to go deeper into this matter may be referred to the works of those distinguished scientists whose researches have done so much to promote the development of the gas engine. The author must acknowledge his obligations to the important works of Mr. Aime Witz, whose theories have constantly guided his investigations; and also to the writings of Messrs. Dugald Clerk, R. Schottler, and Gustave Richard, which are the most complete of all that have appeared upon this subject.

A study of all the patents which have been taken out for gas engines, although a laborious task, will doubtless be undertaken at some future time, and will prove not only interesting but materially useful to those who have set themselves to accomplish the triumph of gas as a motive force over its rival steam.

The Science of Ventilation as Applied to the Interior of Buildings.

[Abstracted from a paper read by Mr. D. D. Hoey, before the Society of Arts.]

First, let it be observed that ventilation belongs to the domain of science, not to that of the fine arts; it is a problem not in architecture, but in physics—a department of scientific engineering and applied mechanics. It is, therefore, natural and antecedently probable that the inventor of the miner's safety lamp, who was the foremost practical physicist of his time, should have succeeded in that in which artistic minds, like those to whose genius we are indebted for St. Paul's Cathedral and the new Houses of Parliament, failed—in elucidating the true principles of the science.

Sir Humphrey Davy's Fundamental Principles.—The following are the fundamental principles established by the father of the science, stated in the form of substantive propositions, with the corollaries necessarily following upon them superadded, whether deducible purely from the principles themselves or revealed by the light of the fuller knowledge subsequently acquired.

First Propostion—Thorough ventilation consists chiefly in two operations, the intimate and invariable correlation of which must be kept always clearly in view, viz., (1) carrying off regularly and constantly the air which has become heated, vitiated and exhausted by respiration, exhalation, vaporization, surplus animal heat, and the lighting apparatus when in use, and (2) introducing fresh, pure air in its place.

Corollaries.—(1) All methods which are limited to one or other of these two indispensable adjuncts are, *ab initio*, defective and devoid of title to the name of a scientific system.

(2) The apparatus for producing the double action must be capable of easy and immediate control, and of instant regulation to the degree of ventilation required under all circumstances, quite independently of wind or weather. Systems of exhaust which depend on the motion of the outer atmosphere are anachronisms; they are literally "as variable and inconstant as the wind."

Second Proposition.—The fresh, pure air must be introduced at a level low enough to mingle with the coolest and best air already in the room, and yield its oxygen uncontaminated for the inhalation of the occupants; all irregular entrances for air, by open or badly-fitting windows, doors, etc., should be closed.

Corollaries.—(1) The air thus introduced must be imperceptibly diffused and free from sensible current.

(2) Entrance doors should be in pairs and on springs, that one may close before the other opens. Windows should be double glazed, which

prevents the downward currents caused otherwise by the large cooling surfaces of glass.

(3) In summer, means should be provided for cooling the air; in winter, for warming it before it is passed into the room. Means should be available for effectually preventing the entrance of fog and "blacks."

Third Proposition.—The most efficient means for carrying off the impure air is an upright shaft, containing a column of air rarefied by heat, communicating at its lower end with the room at or near the ceiling, where the heat and impurity are at their greatest, and at its upper end discharging directly and freely into the outer atmosphere, without the intervention of any foul air chamber or other impediment to the rapid, uninterrupted, upward velocity of the air in the upright shaft, and its continuous, full and unrestricted discharge from the top.

Corollaries.—(1) As the efficiency of the apparatus depends on the heat being maintained, suitable materials or coverings must be used to avoid waste of heat, and produce effective insulation and prevention of radiation.

(2) The upright shaft must be perpendicular throughout, smooth and free from all turns, angles and corners; its full sectional area must be maintained at every point in the shaft itself, and in any hood or cowl by which it is covered; such hood or cowl must be so constructed as not to hinder but to promote the continuous free discharge.

The quantity of air removed is determined (1) by the height and free sectional area of the upright shaft, and (2) by the difference between the temperature of the air within the shaft and that introduced below to displace it. If the upright shaft is at a distance, the connections must be so formed as to conserve its full power of exhaust.

Fourth Proposition.—The inter-relation and balancing of the two processes, of admitting fresh air and removing exhausted air, must be kept clearly in view in any scientific system of ventilation, because they act and react as cause and effect.

These two principles having been ignored, or only partially applied, from the time when Sir Humphrey Davy's system was discarded down to the present time, it follows as a necessary consequence that the systems which have usurped its place are, *ab initio*, unscientific and marred by essential error.

Description of New Method.—I will now proceed to describe the method which has been adopted for giving form and substance to the said abstract principles, with the additional and important specialty of introducing the fresh air for the first time by imperceptible diffusion in the greatest abundance.

Section I.—For the admission of the fresh air without currents or draughts, a dado, preferably about three feet in height, but which may be somewhat higher or lower to suit particular circumstances, is fitted at conveniently available parts around the room, with a narrow space between the dado and the wall, and on the top of the dado wire gauze or perforated metal is fixed in an inclined position, so that articles may not be placed upon it to impede its action. The fresh air is introduced into the dado space at a low level and in a lateral direction to promote diffusion through a number of inlets from the outer atmosphere along the whole line. The total area of these inlets is proportioned to the area of the hot air shaft, after mentioned, for carrying off the impure air. The total space enclosed by the dado, forming a fresh air chamber or reservoir being very much greater than the total area of the inlets from the outer atmosphere, the outer air, coming into this extended space, and entering in a lateral direction, as explained, thus loses its initial velocity, spreads itself slowly over the interior of the reservoir, gently percolates through the innumerable interstices in the wire gauze or perforated metal on the top, and insensibly permeates the atmosphere of the room by imperceptible diffusion, at the low level at which it immediately yields an abundant supply of oxygen to be breathed by the occupants. It is absolutely free from the current heretofore found to set in from the point of entrance of air to the point of exit of air, which has been so invariable as to have come to be erroneously designated an "atmospheric law."

The inlets for fresh air into the dado may be made where suitable, direct from the outer atmosphere, or may be at the bottom of ducts communicating with the outer atmosphere at a higher level, and brought down to the low level at which the air is admitted into the dado space. The admission is regulated by valves fitted into the ducts or into the direct entrances.

The air admitted in the heat of summer may be cooled by means of a frigorific mixture, inexpensive as to cost, contained in a vessel which is placed when desired in a space provided in the inlets or ducts, by which means the entering air passes over and around the refrigerator before coming into the dado space. The extent of cooling can be thus regulated with ease and precision, according to the varying conditions of the outer atmosphere.

In winter the air admitted may be warmed by a heating surface of pipes fitted along the length of the dado. This heating process is under equally easy and simple control. Means are equally provided, where required, for purifying the entering air from fog and from "blacks."

Section II.—For carrying off the impure exhausted air, the needful perpendicular column of highly rarefied air can best be supplied by means of a chimney of suitable capacity, with a close-throated fire grate, or by a connection, properly formed, with any existing perpendicular flue. There should be an opening in the room, at a high level, into an outlet tube communicating with the perpendicular column of rarefied air in the chimney or upright flue. This communication may be made direct at that level, provided there is sufficient remaining height in the chimney above it; if not, the outlet tube should be conducted down to a low level, and the connection there made with the chimney, with a semicircular bend, to avoid corners or sharp curves, which impede the velocity of discharge. In the case of a distant perpendicular flue, care must be taken to make the connection complete, direct and properly insulated.

The close throat of the fire-grate or other entrance into the chimney, at the fire level, or the heating entrance into the distant perpendicular flue, must be just of sufficient area to permit the free passage of the products of combustion, but not to allow other air to enter from the room and cool the chimney or upright flue. Its full power as an exhaust is thus maintained, and the current from the room to the fire heretofore experienced becomes non-existent.

Where a fire is not wanted at any time, as in summer, an arrangement of gas jets with Bunsen burner, or other appliance to consume a large proportion of air and a small proportion of gas, which raises great heat at small cost and free from smoke, is fitted up behind the fireplace to produce the needful expansion of the air in the chimney.

Section III.—When a suitable chimney or upright flue is not available, the same results are produced by a tube of sufficient area and height erected above a sunlight in the roof of the hall, in cases where both lighting and heating are desired to be effected by one means.

When lighting is not desired by such means, or where a separate heater is desired, to be used alone or as an auxiliary to a sunlight, a Bunsen burner, or other like appliance, is fitted in the outlet tube at its lower end.

The height and area of the tube must be sufficient to give a column of air of such capacity as will carry off the exhausted impure air from the room in ordinary circumstances with very little burning of gas, and keep the exhaust going efficiently, with the most crowded attendance in the room, by turning on the gas fully. The amount of air taken off by the outlet tube is effectively regulated by either or both of two means—the use of valves and the degree of heat produced.

The tube should be coated outside with a non-conducting substance to prevent radiation and consequent loss of heat; it should also be covered on the top, outside, by a revolving hood that will prevent ingress of rain, and promote free and full discharge. The best hood is one round-cowled and open-faced, in perfect equipoise, turning easily and accurately with the wind, fitted so as to be incapable of being displaced or put off its true balance.

The special circumstances of all weathers and climates can be met with the same ease and efficiency; the application of the system in Calcutta would be a potent factor in the adjustment of the present serious difficulty in connection with the annual exodus of the whole governing body to the hills.

Practical Application of the System.—I propose now to make a reference to the practical application of the system that may serve to fill up some points of detail which could not conveniently find a place in the general description already given.

The system was first applied in the Bungalow bar of the Glasgow International Exhibition, used for smoking and drinking; 50 feet in length, 20 feet in width, and 11 feet in height; to the entrance of the outlet ventilating tubes = 11,000 cubic feet.

It was lighted by three Wenham lamps, utilized for heating three outlet tubes, 16½ feet in height and 7 inches in diameter, widened out at the lower end. The point of exit of the products of combustion from the lamps was arranged to be about 10 inches below the entrance to the outlet tubes, but they were placed at first at double that distance, with a resulting velocity of discharge of 6 feet per second. On being raised to the desired position this velocity was doubled, thus taking off the entire atmospheric contents of the bar three times every hour, which was in accordance with the calculation made beforehand as fulfilling the requirements of the Royal Commissioners' report, in order to produce perfect ventilation.

The fresh air was introduced by means of a dado or air reservoir, the

whole length of the bar, viz., 50 feet, 3 feet in height and 6 inches in depth, containing 75 cubic feet of air. This reservoir was covered on the top by wire gauze placed on a slope. The inlets into it from the outside were at the bottom, seven in number, equidistant, each 9 inches square, with simple valves for reducing the effective area of entrance of air to any extent. In these entrances metal trays, 9 inches long by 3 inches broad by 3 inches high, were placed on short legs to hold a frigorific mixture when required.

The entrance of air was from one side of the room only, and the apparatus performed its work perfectly, the entering fresh air permeating the entire lower part of the room.

The Estimation and Occurrence of Sulphur in Coal.

Dr. G. H. Bailey, at a meeting of the Manchester Section, Society of Chemical Industry, read a paper on the subject above named. Having examined the various methods in use for determining sulphur in coal, he found that those dependent upon oxidation by chlorate or niter gave results that were invariably too low. The use of large quantities of chloride of soda, niter, and carbonate of soda was objectionable, as likely to induce error—the presence of only 0.1 per cent. of sulphur in the reagents being capable of causing an error of as much as 20 per cent.—and also because the presence of large quantities of alkaline salts in a solution interfered with a complete precipitation of barium sulphate. Oxidation by means of aqua regia was unpleasant to work, and also yielded low results. Eschka's method was found to give constant and trustworthy results, always within 1 per cent. of the mean; and it was also simple. An intimate mixture of two parts by weight of magnesia and one of sodium carbonate (both free from sulphates) was prepared. Two parts by weight of this mixture were carefully stirred in with one part of the coal or coke to be tested, in a platinum crucible. This was very gently heated over a Bunsen burner, and the temperature gradually increased, but never more than sufficient to bring the bottom of the crucible beyond visible redness. This operation usually occupied about two hours, and was finished when the whole mass had become white or light gray, with no black specks. It was then exhausted with water, the clear solution warmed with a little bromine water (free from sulphuric acid), acidulated with hydrochloric acid, and precipitated by means of barium chloride in the usual way.

Mr. Crace Calvert supposed that sulphur exists in two forms in coal—as sulphates and as sulphur in other forms; and that only the latter portion would appear in the chimney gases. He proposed to extract the sulphates by digesting the finely powdered sample with a strong solution of sodium carbonate, and the other forms by oxidation with aqua regia. If Eschka's method was substituted for the latter, better results would be obtained. Some samples of coke residues from the destructive distillation of oil, tested by the magnesia method, showed 0.565, 0.605, and 0.815 per cent. of sulphur respectively. Another analyst, using the chlorate method, gave results below 0.25 per cent. A sample of coal gave 2.72 per cent. of sulphur by the magnesia method, 2.67 per cent. by Crace Calvert's method modified, 2.47 by Crace Calvert's method, 2.14 by chlorate, and 2.04 by niter. Another sample gave 0.13 of sulphates and 2.08 per cent. of sulphur in other forms by Crace Calverts method; but with the magnesia the latter was increased to 2.51 per cent. Three separate determinations on another sample tried by Crace Calvert's method modified gave closely approximating results—averaging 0.27 per cent. of sulphates, and 3.81 per cent. of sulphur in other forms.

The results of some experiments made at Messrs. Bryan Donkin & Co.'s works, Bermondsey, with a view of finding out how far the actual results in practice, as shown by analysis of the chimney gases and also of the ash, agreed with Crace Calvert's rule, were referred to. In the sample of fuel last named (coke breeze), 5.4 per cent. of the sulphur was found in the ashes, 55 per cent. in the chimney gases, and 39.6 per cent. was unaccounted for. Very similar results were obtained with Welsh and with Newcastle coal—viz., about 5 per cent. in the ash, 53 per cent. in the gases, and 42 per cent. unaccounted for. From these results it appears that the sulphates do remain with the ash. The 40 per cent. of sulphur unaccounted for must have been deposited in the flues or on the boiler plates; and this shows that the sulphur in the fuel is not a matter to be disregarded in boiler heating. A large quantity of the sulphur was retained by the flue dust; several samples containing as much as 15 to 20 per cent.

Some samples of coal were subjected to dry distillation. In certain cases very little sulphur came over in the earlier stages of the distillation; whilst in others a great deal was evolved at this period. The percentage of sulphur remaining in the coke varied considerably. Two samples of coal of a very similar character in regard to ash, yield of coke, and relation of sulphur as sulphates to sulphur in other forms, containing respectively 1.83 and 1.10 per cent. of sulphur, gave 58 per cent. and 73 per cent. of the total sulphur in the coke. The first-named contained much oxide of iron in the ash, and the latter very little. There were two coals, one of which gave off 42 per cent., and the other 27 per cent., of its sulphur with the volatile matters; and this opened up a question of considerable importance in the manufacture of coal gas. This matter was worthy of further investigation, especially in regard to whether the sulphur appeared in the gas as the readily removable sulphureted hydrogen, or in other forms that were not completely got rid of by the usual process of purification.

In the course of the discussion that followed the reading of the paper, Mr. P. Hart suggested that some of the sulphur might pass away in combination with ammonia or with hydrocarbons. Also that Mr. Davis's method of estimating the sulphur in spent oxide—by combustion in a gas furnace, and absorbing the sulphurous acid by hydrogen peroxide—might be applicable to fuels.

Mr. Watson Smith drew attention to M. Brulle's method of using a long, narrow platinum boat covered with a sliding lid, which had the advantage of holding all the mixture in a thin layer. A little chlorate of potash and niter was strewn on the top of the mixture, the cover put on, the whole introduced into a combustion tube, and the space above the cover packed with some of the mixed salts. The tube was heated in the usual way, after which the mixture was precipitated. M. Brulle objected to the ordinary methods, and especially to combustion in a crucible, as likely to cause loss of sulphur.

Mr. J. E. Holgate had used the lime process regularly for 8 or 9 years, for estimating sulphur in coke for blast-furnace use, and found it highly satisfactory. The sample was mixed with 1 to 1½ times its weight of pure lime, made into a paste with water, dried at a moderate heat, and ignited in a muffle at a good red heat until all the carbon was burned off, which usually took from 30 to 60 minutes. After cooling, it was transferred to a beaker, dissolved in dilute hydrochloric acid, heated to boiling point, and filtered. Most of the free acid was then neutralized with ammonia, and the sulphuric acid precipitated in the usual way. A little bromine water was sometimes employed; and a small quantity of fresh lime might be sprinkled over the mass previous to ignition to avoid loss of sulphur.

Dr. Bailey, in replying, did not accept Mr. Hart's suggestion, as he thought the sulphur would be retained by the potash in the ash. He believed the lime process was as accurate as the magnesia; but considered the latter to be preferable, as not requiring the addition of acid, and also as being conducted at a lower heat.

Flexible Metallic Tubing.

Invention notes that the new flexible metallic tubing which is being brought forward by a company, may soon be expected to come into very general use. Indiarubber, common leather, or combinations of these have until now been used in the many cases in which flexible tubes are required for the conveyance of gas, liquids, steam, etc. These materials, however, are not only very expensive, but also liable to wear out in a short time; and the introduction of the new tubing, which is both flexible and durable, will therefore be warmly welcomed.

The metallic tubing can be made in nearly any kind of metal, and weighs about the same as indiarubber tubing of equal diameters and strength. Briefly stated, it is composed of a long, narrow strip or band of metal, corrugated and wound spirally in such a manner that a flexible and continuous tube is thereby formed. Between the joints of each lamination of the spiral tube a minute strip of indiarubber or other material is interlaid, which, while keeping the tubing perfectly air and water-tight, is covered up in the corrugations, and thus protected from all wear and tear. The machinery used in its manufacture is comparatively simple, while one machine, working continuously 10 hours a day, is capable of producing about 600 yards per day.

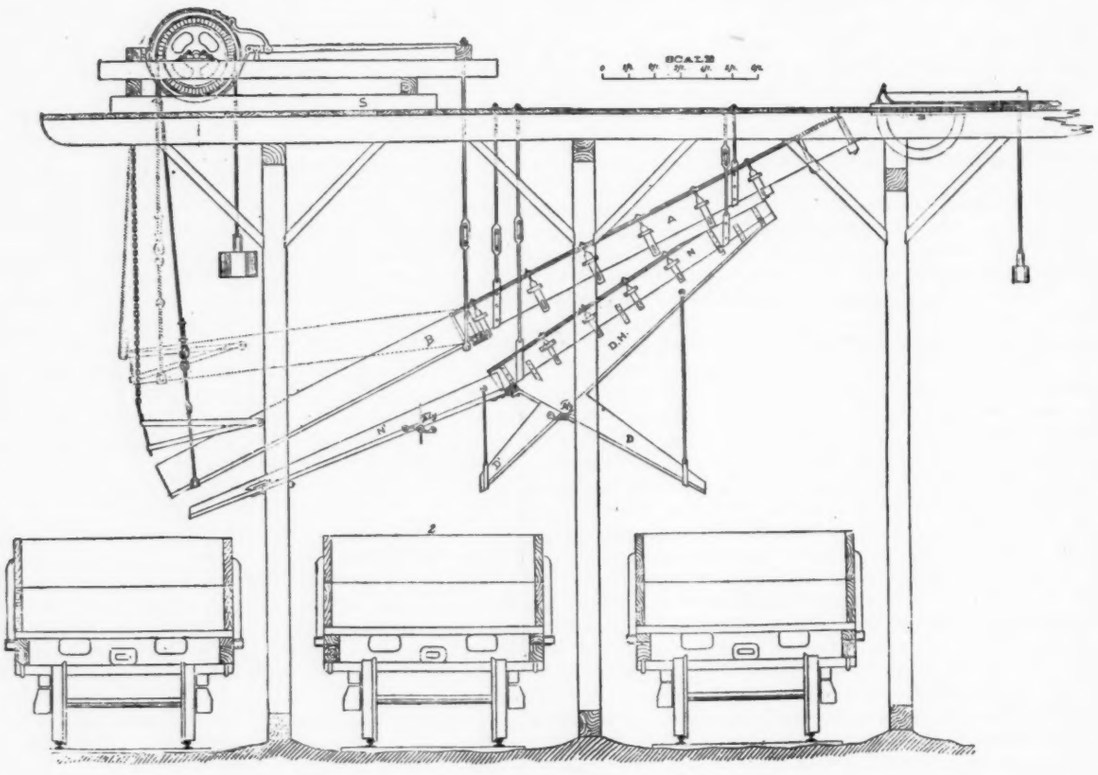
The field for this new tubing is, of course, most extensive. Not only for domestic use for gas connections to lamps, stoves, etc., but also for use with gas engines, steam connections of every kind, hydraulic and compressed air tubes for mines, factories, etc., brewery tubes, speaking tubes, suction tubes on board ship, garden and fire hose, this new tubing should prove most valuable. How large the use of garden hose is in this country alone need hardly be pointed out, and precisely for that purpose the new flexible tubing, which is not affected by heat or cold or rough handling, will, no doubt, altogether replace the rubber hose now so largely used and so quickly worn out. A very large application of

flexible tubing is that in breweries for cleansing and other purposes. As the tubing is of a very ornamental character, it should commend itself specially for gas connections in private houses. It can be lacquered, bronzed or plated, and will certainly prove safer than indiarubber tubing, which only too easily springs a leak and thus causes an escape of gas which may prove very dangerous. Nor would the new tubing be injured by being trodden upon, like the indiarubber tubing. Where high pressure is used indiarubber tubing has at present to be built up with many plies interwoven with other material, while the flexible tubing need only be slightly increased in thickness of metal, and here the excellent qualities of the new invention are brought out very plainly.

Flexible metallic tubing is largely employed in the Pavilion du Gaz, at the Paris Exhibition, and has ere this obtained a gold medal at the Paris Industrial Exhibition, and a special money prize and medal for extreme excellence at the Paris Exhibition. It will doubtless gain many more prizes, and, above all, prove an immense boon in many industries and in our homes.

The Lily Railroad Tipple.

In the cut, *A* shows the lump screen, which is usually 17 ft. long out-to-out; 12 ft. by 5 ft., over 1¼ in. by ⅝ in. by $\frac{5}{16}$ in. steel screen bars,



which are set in wrought iron bearers; 4 ft. top and 12 in. bottom steel plates, 16 in. by $\frac{5}{16}$ in. steel sides, braced with steel angles. The screen is usually hung 6 in. to 12 in. With the aid of turnbuckles the pitch can be altered in a very short space of time to suit either wet or dry coal. At *B* is shown the weigh-basket—from 12 to 20 ft. long, depending on elevation of tipple—which is constructed of steel plates and angles. The upper end is rendered stationary by means of a rod leading from its axle to the scale timbers. The bridle at the lower end is fastened to a ⅞ in. steel rope, to which is attached a counterweight, the same being heavy enough to raise the end of the basket quickly when empty. The rope coils around a 3 ft. drum, which is set in the scale timbers and controlled by a brake with lever conveniently placed. *N* is the nut screen, 12 ft. long; 10 ft. by 5 ft., over 1 in. by ⅝ in. by $\frac{5}{16}$ in. steel screen bars, 12 in. by ½ in. steel sides, constructed same as lump screen. *N'* is a steel nut chute; *D D'* are slack chutes; *D H* is the slack hopper; at *S* is shown the scale timber.

The tipple is operated by one man in the following manner: The mine car being run into the tipple horns, which are held in position by a wedge or other suitable brake, the operator releases the latter, dumping the coal on the 4-ft. plate at the top of the lump screen, which scatters it before it reaches the screen bars. The latter, passing over the bars (which are spaced at different widths, according to the mining practice of the State), enter the weigh basket, which is held by the brake on the drum at about 2 in. to 12 in., so that the coal slides into it and is stopped without breakage. The operator then takes the weight on the scale (the beam of which is located near the tipple horns), and raises the brake lever (also conveniently placed), which allows the end of the basket to drop, a chain raising the door at the desired height depositing the coal in car No. 1 without a lump being broken after leaving the screen. The basket is then brought back to its first position by the counterweight. The coal passing through the lump-screen drops in the nut screen; the nut passing into car No. 1, or can be dropped through the fly into No. 2. The slack passing through the nut screen goes into car No. 3, or, with the fly in hopper, can be loaded into car No. 2. Working on this general plan, using the patent box car chute, with which the basket can be dumped either into the box car outside, or gondola No. 1 by simply pulling a rod at tipple's horns; and the owners of the patent have constructed a tipple for Col. W. L. Scott, at his Scott Haven (Pa.) property—also one for the Shauer Gas Coal Company, at Guffey station, on the B. & O. Railroad—over which 1,200 tons lump coal (over 1½ in. screen) can be weighed and loaded in box and gondola cars per day. The coal, at the will of the operator, may be altered to any combination of size without a moment's delay.

The Luminous Fountains at the Paris Exposition.

Engineering says that for quite a long time the illumination of cascades by the electric light has proved a never-failing source of pleasure to the public; the lighting up of the Falls of Niagara in this way is one of the most beautiful spectacles that can be well imagined. But this method of illuminating falling water has lost its novelty, and a new idea, which was put in practice in London a few years since, has taken its place. This is to imprison the luminous ray itself within the liquid jet, and that so perfectly that each particle of water becomes, as it were, incandescent, whilst the whole stream is transformed into a brilliant mass of molten gold or silver, of any color that it might be desired to impart. Before the eyes of the astonished spectator the jets of water suddenly change in the intensity of their light and color; luminous in themselves, and sparkling like a display of fireworks in the darkness, they throw in-

numerable sparks in all directions, but unlike a display of fireworks, which only lasts for an instant, the effect can be prolonged for any desired time. The variations in the luminous intensity, as well as in the power and heights of the jets, combine to give a special charm to the effects produced; sometimes a great central jet shoots upwards, surrounded by a number of smaller ones, then suddenly these latter swell to larger proportions in their turn, while the central jet, diminishing in height, loses itself under the dome formed by the graceful curves of the streams of water that surround it. Added to this are the sudden changes of coloring and the blending of varied tints of extraordinary brilliancy which light up the same jet with many different colors. The spectacle is truly marvelous and difficult to describe.

Collectively, the luminous part of the great fountains comprises 48 distinct groups, formed of about 300 jets discharging 45,000 cubic feet per hour; the electricity employed for lighting this mass of water absorbs nearly 300-horse power; the water is taken from the Seine, being stored up in the reservoir of Villejuif, whence it flows with a difference in height of 292 feet from a series of cornucopiæ, and from a series of figures representing dolphins, forming together groups of parabolic jets. From the upper basin the water falls over a length of 130 feet into the lower one.

It is explained that the illumination of the jets is effected by permitting the light and the water to escape from the same orifice, the different colors being produced by the interposition of sheets of tinted glass.

In some cases the jet is annular, the beam of light being directed through the central opening. In either case the liquid is apparently saturated with light, producing the effects above described.

An Engineer's Opportunities.

The *American Engineer*, in editorially commenting on the above topic, admirably explains that the stationary engineer's occupation, in a great many cases, is not only an onerous one, requiring constant physical exertion, watchfulness, and care, but also one that calls for thought, reflection, and presence of mind. There is always something to be done, either in the way of cleaning, adjustment, or repair. He has to work early and late to keep things going. But there are also other cases where the plant can be kept in good condition with comparatively little trouble. The boiler pressure is easily maintained, the speed is regular, there are no hot journals, no unreliable pumps. If the engineer is a systematic man, who likes cleanliness, order, and "first-rate condition" of things about him, we shall see boilers, engines, and machinery kept in such admirable order that there is no mistake about the right man being in the right place.

An engineer with these qualifications and traits of character feels that he cannot bring too much concentration of thought upon immediate duties. His mind will not wander far from his charge. In the boiler or engine room he saves his moments of rest for thought, reflection, and study. How many useful and ingenious inventions can be traced to an engineer's study in his engine room? Boiler and engine rooms are engineering schools, where the practical engineer may think out a scheme or make an improvement. This is the sort of culture and self-education that gives us "self-made men." The boiler room—a place to observe and think; the engine room—a school of applied science.

If the boiler room, for instance, is of uncomfortably high temperature, the thoughtful engineer will study how to cool it; if anything interferes with personal comfort, or blocks facilities, or impedes operation, his mind immediately turns to removal and remedy. The same thing will occur in the engine room. There he reflects to obtain the nicest adjustments and indications; thinks out little useful devices; makes up his mind what he would do in case of accident, and studies to be complete master of the situation.

Such an engineer gives dignity to his calling. He observes, thinks, studies; acts intelligently, promptly, and successfully. To him there is always something for mental daily bread.

But such habits of thought do not come at call. To study in the right direction, the mind has to be cultivated by reading, by interchange of opinions, by the knowledge of the nature of materials and the operation of apparatus. A man may think a great deal, and yet be thinking under wrong impressions and with erroneous ideas. It is a grand mental accomplishment to think in the right direction.

Here, then, we see that the boiler house and engine room become schools for thought and ingenuity to those who will use them as such. But there are also opportunities for self-culture and mind improvement at the meetings of the numerous Engineers' Associations throughout the country. Some of these are doing a most commendable work in diffusing useful knowledge by furnishing lectures, models, books, discussions, relations of observation and experience which all teach something. We very earnestly advocate lectures by competent lecturers for every association—lectures on chemistry, on applied science, on mechanics, on drawing, air, water, steam, electricity, etc. There is no more pleasing way of imparting knowledge than by lectures illustrated by models, maps, diagrams and apparatus.

Every Engineers' Association can do something in this direction, affording excellent opportunities for its members to learn about subjects that are both interesting and helpful.

Engineers and mechanics, after a day's work and confinement, are not disposed to sit down to close reading and study; they need recreation and rest. The most delightful recreation to a thoughtful engineer is to listen occasionally to an illustrated, scientific lecture, which in one hour will, probably, give him more insight and instruction than a long, tedious perusal of books can ever do.

Engineers, your opportunities are in your own boiler house and engine room, and in the educational work of your Associations, every one of which should be a mechanics' institute in miniature—with its lectures, books, apparatus and mechanical drawing class.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. N. O. GOULDING has resigned the Superintendency of the Eastport (Me.) Gas Light Company.

THE proprietors of the Lawrence (Mass.) Gas Light Company have empowered Agent Humphreys to announce a concession in gas rates, which is equivalent to an all-round reduction of 10 cents per 1,000 cubic feet. Hitherto the gross rate was $1.70 per 1,000, with 10 cents off for prompt payment, but hereafter the rebate is to rule at 20 cents. This is good testimony to the carefulness of Agent Humphreys' management.

AMONG the recent orders for compound engines the Westinghouse Machine Company reports the following: One 35-h.p., three of 50, five of 65, two of 100, one of 125, seven of 150, seven of 200, one of 250—or a total of 27 engines, aggregating 3,535 horse power.

THE Gloucester (Mass.) *Breeze* has made a discovery to the effect that the Salem Gas Company is removing its lamp service pipes from the streets of that city because "the Company never expects to furnish any more street lights to the city." Our breezy friend is hereby informed that the Salem Company is removing the services for the simple reason that the Superintendent desires to cut down the leakage to the lowest possible figure.

"AT a meeting of the stockholders of the Cartersville (Ga.) Water Works Company, J. H. Vivion was called to the Chair and Douglas Wikle acted as Secretary. After adopting by-laws for the government of the Company and transacting other business incident to its organization, the following Directors were elected: J. H. Vivion and John A. Stover, of Cartersville, and A. E. Boardman, J. S. Baxter, and R. L. Henry, of Macon. The stockholders' meeting then adjourned, and the Directors met and elected the following officers for the ensuing year: President, J. S. Baxter; Treasurer, A. E. Boardman; Secretary, Douglas Wikle. The Company is a strong one, and when its plant is completed Cartersville will have one of the best systems of water works in the State. It is the purpose of the Company to put water in the town by Oct. 1. This will show to his friends that the Macon gas man is again about to enter the field of active work.—F."

WE understand that the property of the Appleton (Wis.) Gas Light Company has been sold at auction to satisfy a trust mortgage deed held by Jonathan Bunce, of Boston, Mass., who foreclosed because of default. The property was bid in by the stockholders at their offer of $17,500.

"WHEN I wrote you some weeks ago that the gas and electric light interests at Fargo, Dakota, had been consolidated, I also said that extensive improvements would be made in the electric department, so that the service could be depended upon at all times. This prediction has since been verified. A Hazelton boiler has since been installed, which, with the others in use, insures a power of 415 horse, and will be employed in driving three engines—one a 4-valve type of the Russell class, the others being of the Corliss variety. Other betterments bring the plant out in striking contrast to that which it replaced.—FARGO."

AT the annual meeting of the Greenfield (Mass.) Gas Light Company the following results were reached: A dividend of 2 per cent. (semi

annual) was declared, and the officers chosen were: President, F. R. Allen; Clerk and Treasurer, Dana Malone; Directors, F. R. Allen, F. A. Pond, W. N. Washburn, W. A. Forbes, and J. D. Safford. In connection with the seemingly low rate of dividend declared, it should be borne in mind that large payments for betterments were this year made out of revenue account.

A CORRESPONDENT, who has been inspecting the machinery exhibits at the "Royal" Show, at Windsor, England, writes that he was greatly interested in the display made by the Campbell Gas Engine Company (Limited), of Halifax. The Company, he writes, is represented by three sizes of engines—½, 3, and 6 horse power respectively—which are notable for their compactness of form, and their lightness of weight in proportion to their power, which are great advantages when a motor is to be installed on the upper floors of a building. In the case of this engine an ignition is obtained at every revolution, when working to full power—a provision that conduces not only to steadiness of running but also of reducing the space occupied. The foundations are not of great moment—that is, as to special construction—and the engine may be worked direct from one meter. The exact quantity of gas required to drive is automatically regulated by a governor, where the duty exacted is of a more or less intermittent character. The Campbell engine has no slide requiring adjustment or overhauling. The cylinders are made of the best cold-blast iron, and the working parts are of steel, hardened where required. These motors may be combined with pumps, fans, or dynamos, where required. Our correspondent inclines to the view that the smaller sizes (especially) of the Campbell engine are likely to command a ready sale.

THE proprietors of the Moorestown (N. J.) Electric Light, Heat, and Power Company are constructing at that point an incandescent electric lighting station, to be equipped with a plant of the Thomson-Houston type. It is rated to a capacity of 1,000 lamps, and it is presumed that everything will be in working order by Nov. 1. Their attempts to secure contracts with private consumers are based on the following promises:

Commercial or Store Lighting, Monthly Rates.

Hours of Burning.	Candle Power of Lamps 10.	16.	25.	32.	50.
From dusk to 10 P.M....	$0.65	$1.00	$1.50	$2.00	$3.20
" " midnight..	.80	1.25	1.80	2.40	3.80
" " daybreak..	1.10	1.50	2.25	3.00	5.00

House Lighting Contracts—10-*C.P. Lamps.*

One lamp	$0.65 per month.
Two lamps	1.25 "
Three "	1.75 "
Four "	2.15 "
Five "	2.50 "

and 10 cents per month additional for every lamp more than five. These lights are in circuit from dusk to daybreak.

House Lighting Contracts—16-*C.P. Lamps.*

One lamp	$0.90 per month.
Two lamps	1.70 "
Three "	2.40 "
Four "	3.00 "
Five "	3.50 "

If the prospective consumer prefers to chance his supply through a meter, the Company will furnish the latter "free of cost—when current will be charged for at the rate of one cent per ampere," which quantity the circular intimates is "slightly more than will be consumed per hour by one 16-candle power lamp," or a monthly charge of $1.50 will be made for each meter, entitling the consumer to the consumption of 150 amperes of current. If, however, more than 150 amperes of current be consumed in any one month the regular charge of one cent per ampere will be made as indicated by the meter. Consumers using meters are to be furnished with renewals of burned out lamps free of cost; but lamps broken before their lighting life had expired must be renewed at the expense of the consumer. As a "special inducement" the Company will, until November 1st, make no charge for plain, open-cleat wiring, the consumer to pay only net cost price to Company for fixtures, shades, holders, switches, etc.

THE Jamaica (L. I.) Gas Light Company, owing to the greatly increased demand for gas in that town, has added to its holder capacity.

GEO. W. HOPPING, Chairman of the Bloomfield (N. J.) Committee on Electric Lighting, favors the purchase by the township of an electric lighting plant, the same to be operated by the authorities.

THE St. Louis City Council is briskly engaged in devising means for the revision of gas rates in that city. One of the latest suggestions is that the rate per 1,000 cubic feet shall be fixed at $1.18, with the proviso that in case bills are not paid on presentation the companies may collect thereafter $1.25 per 1,000.

IT is said that the Addicks syndicate have purchased a plot of land adjoining the Harlan and Hollingsworth ship yards, and almost opposite the site of the Wilmington (Del.) gas works, whereon to construct an opposition gas plant. At the price said to have been paid for the plot ($6,000 for 5 acres) the investment might be considered a good one from a real estate speculator's point of view, even though a gas works were never put on the site.

THE St. Thomas (Can.) Gas and Electric Company has added a new dynamo (capacity, 200 incandescent lamps of 16-candle power each), of the Reliance type, to its electric plant.

IN a former issue we noted the consolidation of the Belfast (Me,) Gas Company and the local Eastern Electric Light and Power Company. The officers of the consolidated enterprise are: President, W. B. Swan; Secretary and Treasurer, J. H. Quimby; Directors, A. K. Pierce, C. Baker, A. A. Howes, R. N. Moody, S. G. Dovan, E. R. Pierce, J. H. Quimby, W. B. Swan, C. B. Hazelton, N. R. O'Connor and N. F. Houston.

SUPT. WILLIAMS, of the Paterson (N. J.) Gas Company, is engaged in extending the main system through Broadway from East 33d to East 27th streets. This shows that the local electricians, despite their boastings, have not been able to retard the progress of the gas men.

WHEN the floods that visited certain portions of this State had subsided another and even greater danger came upon the inhabitants of the afflicted districts. The slimy refuse that was abundantly deposited soon gave off most noxious vapors, and the local authorities were in many instances sorely pressed to secure an abundant and speedy supply of disinfectants. At Elmira, Health Officer Reilly, having exhausted the resources of the local lime kiln of Messrs. H. Barney & Co., applied to Mr. Arnot, Treasurer of the Elmira Gas Company, for information as to the Company's lime supply, whereupon Mr. Arnot suggested that the refuse lime in the yards might be found available as a disinfecting agent. Acting on this suggestion, the Health Officer experimented with the material, and he has since, in a report to the Board of Health, given it as his opinion that the fouled lime of gas works is a very much better disinfectant than the ordinary fresh lime of commerce. Candor, however, compels us to add that some of the residents of Elmira are on record as saying that "the foul lime cure was almost as bad as the disease which it sought to combat."

"I NOTE your recent intimation concerning the probable animus of the projectors of the Metropolitan Gas Company, of Elizabeth, N. J., and believe that you are not far wrong in your surmises. I must say, however, that the proprietors of the Elizabethtown Gas Company have not shown any particular energy in attempting to interfere with the progress of the opposition, although towards the close of July a rather feeble attempt at a contest was initiated. Thinking that some account of this might interest your readers, I forward the following condensed report of the move made in Council about a fortnight ago. The Elizabethtown Company, in supplement of its application to Chancellor McGill for an injunction restraining the Metropolitan Company from proceeding with its main laying operations, also presented a remonstrance at the meeting of the City Council. Dr. Mravlag handed in the remonstrance, which was based on the allegation that the Metropolitan Company had no right whatever in the district, in that it had no franchise from the city, and that the charter under which it was proceeding had really expired in 1873. The remonstrance further said that the motive of the opposition, as put forward, was a sham, in that the proprietors of the Metropolitan Company had offered to sell out to the remonstrants. The latter concluded by asking for an investigation of the charges thus made. On motion, the paper was referred to the Law and Street Committees. This action was followed by the reading of a letter from Street Commissioner Stratemeyer, who wrote that when the Metropolitan Company began to open the streets without a permit he consulted the City Attorney, and they (the Commissioner and the Attorney), owing to the magnitude of the work, concluded to permit the Company to continue the work until the meeting of the Council. He then asked for further instructions. Mr. Manning followed with a resolution that the Company be granted permission to open the streets, in consideration of a bond of

$1,000, and that it be restricted to opening but 600 feet of any street at one time. Mr. Halsey thought the matter of the health of the citizens, which he thought would be imperilled by such wholesale overturning of the soil, should be carefully looked after, and that the Council should move slowly. Dr. Mravlag referred again to the old Company's remonstrance, and thought it but simple justice to the latter that an investigation should be ordered. In any event, the new company could not be seriously harmed in the event of the suspension of its work for a few days. Labor-agitator Connolly here interpolated 'a few remarks' on the hardship that would be occasioned to the laborers employed in case the work was suspended. He thought enterprises of this nature ought to be encouraged instead of being hindered. The Council had been 'liberal' in its dealings with other corporations, and he failed to see why liberality should not prevail in this instance. Mr. Benjamin said he believed in giving the new Company all the privileges to which it was justly entitled, but he thought the charges made so plainly should be investigated. Mr. Egenolf agreed with Mr. Benjamin, and on a motion made by the former, the Manning resolution was laid on the table for one week. I have no doubt that if the Metropolitan Company, provided its managers are in earnest about the construction of a gas works—and it is not certain that they are—wishes to go ahead the Council will not stand in the way; for the management of the old Company, more particularly perhaps in the past than now, has not been popular with the residents. No matter what the outcome of the struggle is to be, I would like here to call attention to the free and easy manner in which the Street Commissioner and the City Attorney decided, owing to 'the magnitude of the work,' that the projectors of the opposition Company might tear up every street in the city, regardless of the fact that they had or had not any franchise right.—NEWARK."

SOME months ago we noted the institution, by the Little Falls (N. Y.) Gas Light Company, of a suit against Messrs. T. Sullivan & Co., who, in the construction of a water works plant at that point, had disturbed and injured the mains of the gas company. Complainant prayed for damages, to be assessed by competent persons; and Judge Smith, before whom the case was argued, has rendered a decision in favor of plaintiff.

THE rejuvenated works of the Warren (R. I.) Gas Light Company are in operation. The selling rate has been fixed at $2 per 1,000 cubic feet, as against $3 per 1,000 charged by the former management.

CONTRACTORS are advised that the Trustees of the Hamilton, O., gas works will, up to noon of the 20th inst., receive sealed proposals for the excavating and filling of 30 miles (more or less) of trenches for the reception of cast iron street mains, according to the specifications now on file at the office of the Trustees. Proposals for caulking and back-filling are also asked for.

MESSRS. LEONARD & SIMMONS and Brown Bros. have been awarded the contracts for certain excavations and mason work connected with the plant of the Superior (Wis.) Light and Fuel Company.

THE *ci-devant* diamond broker, Mr. Fred. Bredel, is again trying his luck in the Gogebic range of lakes. He had to come on to New York, though, for an extra supply of tackle.

"NEW ORLEANS, LA., July 29, 1889.—Notwithstanding the cogency of the argument, made before the Mobile (Ala.) City Council, by Mr. Rubira, of the old Mobile Gas Light Company, against granting the projectors of the Alabama Gas, Electric Light and Motor Company the right to operate an opposition lighting plant in Mobile, the General Council, assembled in special session, on the 26th ult., admitted the speculators to the city. The ordinance specifies that the new company shall not consolidate with any existing company, shall locate its plant in the corporate limits, and complete the same before laying any mains, the work to be commenced within 8 months, and to be completed in 18. The maximum rate for gas is fixed at $2 per 1,000. Rumor has it that the ordinance would never have been passed were it not for the fact that the manipulators managed to interest one or more Councilmen in the scheme, and as it was, the contest was a very close one, the decisive vote being 7 in favor to 6 against. The Mayor may possibly veto the fran chise.—C. T. F."

THE public building at Grand Rapids, Mich., is to be lighted by electricity, the Grand Rapids Edison Light and Fuel Gas Company having agreed to undertake the task for $100 per month. About 200 incandescents (and 1 arc light at main entrance) will be necessary, "most" of which, our correspondent adds, will be of 16-candle power each. The lights are to burn from dusk until 11 P. M.

WE understand that Messrs. N. M. Jones and Frank Bierce, of Memphis, Tenn., and Mr. T. I. Springer, of Chicago, are in negotiation with the proprietors of the Pulaski Gas Light Company, of Little Rock, Ark., the object being to change the plant of the latter from a coal gas to a water gas type.

RECENT advices from Fort Wayne, Ind., are to the effect that the Kerr Murray Manufacturing Company is as busy as ever, wherefore it may be taken for granted that President Cressler is happy. The Company has just completed the rebuilding of the gas works at Bowling Green, Ky., the betterments including the addition of a new bench of 5's, a steam-jet exhauster, condensers, scrubbers, purifiers, etc., for coal gas. At Pittsburgh (Pa.), for the Pittsburgh Gas Company, the Kerr Murray folks are under contract to supply self-sealing mouthpieces to 14 benches of 6's—the Pittsburgh Company's benches are being refitted completely. Still another contract is that for a 20,000 cubic foot capacity holder for the Oskaloosa (Iowa) Gas and Electric Light Company. To crown all, comes a contract for a new coal gas plant for the Knoxville (Tenn.) Gas Light Company. This plant is to have a daily capacity of 500,000 cubic feet, the leading features of the same comprising 10 benches of 6's, 18-foot purifiers, with 16 inch connections, etc. Quite a goodly lot of work.

THE Derby Gas Company, of Birmingham, Conn., will supply incandescent electric light in the adjoining village of Ansonia.

THE total number of gas street lamps in Milwaukee, Wis., is 2,419. All the lights are turned on 30 minutes after sunset and extinguished 50 minutes before sunrise. The burners used are rated to pass either 5 or 6 feet per hour—the latter type being employed in the more thickly populated districts—and the gas consumed is charged for at the rate of 90 cents per thousand cubic feet. According to the lighting schedule followed, the annual cost of each street lamp is shown to be: In the 5-ft. class, $24.17; in the 6-ft. class, $27.60. The Badger Illuminating Company supplies 185 high-power arcs, and is paid therefor at the rate of $150 each per annum.

SOME time ago we reported the passage by the St. Louis City Council of an ordinance directing the sale of 200 shares of gas stock, held by the city in the old St. Louis Gas Light Company, at the upset price of $375 per share. Mayor Noonan subsequently vetoed the measure, but signified his willingness to sign an order for the sale of 199 shares, or any smaller number, on the ground that he desired the city to retain a holding that would enable it at any time "as an interested party to look into the Company's affairs."

WE are called upon to chronicle the death of Mr. Charles Gould Steele, who was prominently identified with the Buffalo (N. Y.) Gas Light Company. Deceased, who was in his 48th year, was a son of the late Oliver G. Steele, one of the founders of the City of Buffalo, and will be remembered by the fraternity from his long official connection with the Buffalo Gas Light Company in the capacity of Secretary and General Manager.

"THE annual meeting of the Taunton (Mass.) Gas Light Company was duly held, and the shareholders wisely continued in office the men who have so long and capably directed their affairs. I am sorry that I am prevented from revealing any of the details connected with the annual reports; but I may say these show that the Company never was in better financial condition.—OBSERVER."

THE works of the Lee (Mass.) Gas Light Company were almost totally destroyed by an explosion that occurred on the evening of the 23d ult. The plant will be restored at once.

PRESIDENT HALL, of the Consolidated Company, Baltimore, says that no definite steps for the supply of fuel gas in that city by his Company will be taken until well along in the fall. In the meantime, every process that seems to have merit is being quietly and thoroughly investigated.

SOME time ago the Roxbury (Mass.) Electric Light Company applied to the City Council for the right to operate a plant in that suburb of Boston. Permission being refused, the Company appealed to the Board of Gas and Electric Light Commissioners, who also rejected the petition, basing their refusal on the ground that the Boston Electric Light Company could, through an extension of its system to the district in dispute, supply the residents with electric light at a figure much cheaper than if the service were rendered by an independent company.

THE authorities of Camden, N. J., are considering the feasibility of lighting the streets by means of incandescent electric lights, of the 30-candle power variety.

THE Council of Irwin, Pa., proposes to enforce the ordinance under which the Irwin Gas Company is operating. It is claimed that under the terms of the agreement the Company agreed to furnish gas to the street lamps free of charge, but that in reality it insists on payment for the service so rendered.

THE City Council of Toronto still persists in treating the application of the Consumers Gas Company for the right to supply incandescent electric light with, to say the least, rather curiously appearing indifference. Not content with ignoring the legal right of the corporation to, under certain conditions, supply the inhabitants with artificial light of any and all descriptions, the Council, in its eagerness to favor a rival lighting company, has ordered a wholesale discontinuance of gas street lamps, to the end that lights of the incandescent electric variety might be made room for. And this, too, in face of the fact that the contract under which the Gas Company is carrying on the lighting supply does not expire for perhaps 18 months. The entire course of the authorities in respect to their recent dealings with the Consumers Company has been marked by such harshness and unfairness that even the local newspapers—never over-friendly to the Company—are prompted to inquire as to the probable animus of the principal urgers of the opposition, whose tenacity in the latter regard may rest on an odd foundation. A recent issue of the Toronto *World*, in editorially dealing with the situation and its problems, thus treats the subject, under the suggestive title of "Where is the Ethiopian?" "We do not think the Consumers Gas Company has been fairly treated by the City Council in the matter of street lighting, or in the refusal of permission to use the streets of the city for the purpose of incandescent electric lighting. In regard to the first it would appear evident that the hasty action of the Fire and Gas Committee in ordering the extinguishment of a large number of street gas lamps, and substituting electric lamps therefor, would involve the city in serious litigation, as the solicitors of the Consumers Gas Company have advised them that the city has no right to cancel the gas lamps until the expiration of the contract, which will occur in about 18 months. Indeed, the city's own legal advisers have as good as told the Lighting Committee that they could not compel the Gas Company to put out the street lamps when so ordered by the Fire and Gas Committees. Acting on this advice, the Gas Company intend to proceed against the city for strict enforcement of their contract. Another thing is that the Gas Company invested nearly $100,000 in laying gas mains in new streets and in new districts where there was no prospect of private consumers in order to supply street lighting for the benefit of the citizens, and now the City Committee turn round and say to the Gas Company, 'We don't want your gas lights; turn them off; we will not pay any longer for them,' and proceed to order electric lamps from another Company in their place. This is neither keeping faith with the Gas Company, nor carrying out the contract. Then, again, the electric lights in the center of the city average about 400 feet apart—the gas lamps are only 200 feet apart—and in any case only two gas lamps, costing the city $41 a year, are extinguished, and their place taken by one electric light, which costs $90 per year. These electric lamps, costing the city double the money, are being placed where they are certainly not wanted for the present, and therefore the money is being as good as thrown away. Still, again, the Gas Company at a large outlay made and erected a lot of Lambeth lamps and placed them wherever ordered by the city. These are all also being canceled by the Committee of the Council in favor of electric lights which cost double the money. In the matter of the right to use the streets for wiring the city, we fail to see that justice has been done to the Consumers Gas Company in the refusal of a franchise which has been granted to other companies. Such discrimination has been shown in no other city or municipality that we know of. Only a month or two ago the Cincinnati (O.) Gas Company was accorded this very privilege. It is true that the Consumers Gas Company is a wealthy corporation, but this is no reason why it should not be accorded fair play. It has steadily been reducing the price of gas, and was prepared, had it been treated fairly by the Council, to make another reduction in the price of gas to all consumers, the city included. Moreover, it is a concern in which the citizens have a more or less direct interest, as the larger the business it does the more it will make, and the money it makes beyond a certain definite percentage it must restore to consumers in the way of a reduction in the price of gas. The citizens have no such safeguards in regard to the Toronto Electric Light Company, which, for some reason not known to the public, is an especial favorite of the Fire and Gas Committee aforesaid. This unjust discrimination does not seem to be in the interests of the citizens, and will certainly not be in the interest of the city treasury, if the Gas Company go to law and establish their contention for the fulfillment of the contract which they now hold with the corporation. Some people are asking in a suggestive way whether there is an Ethiopan in the woodpile or not. If the people keep their eyes open the secret may yet be discovered."

WE understand that the proprietors of the opposition Company at Elizabeth, N. J., have awarded contracts for two gasholders, one of which was granted to Bartlett, Hayward & Co., Baltimore, Md., the other going to the Continental Iron Works, Brooklyn, N. Y.

MRS. W. J. JOHNSON and Mr. Martin Theurer are said to have purchased a controlling interest in the Fort Smith (Ark.) Gas Light Company, and that the plant will be virtually reconstructed. An attempt will be made to use Arkansas coal, which hitherto has not proven a very satisfactory gas producer.

THE Edison plant ordered by the proprietors of the Le Roy (N. Y.) Gas Light Company will be in working order by October 1st.

THE Board of Gas and Electric Light Commissioners have again postponed the hearing on the application of the North Adams (Mass.) Gas Light Company for the right to furnish electric lights. The date named was September 25th.

THE Jamaica Plain (Mass.) Gas Company has declared a dividend of 6 per cent. This brings the return for the last twelvemonth up to 10 per cent.

THERE is no truth in the report that Mrs. Catherine Archer had disposed of her holdings—which virtually amount to control—in the Denver (Col.) Gas Light Company.

MR. D. MCPHEE, Inspector of Gas for the Brantford (Canada) district, has fitted up testing stations at Galt and Listowell. The correspondent who forwarded us this hint adds: "It is sometimes wondered at why there is no inspector of electric lights in this district; for there are certainly times when we need one."

MR. PETER BAUER has been appointed General Manager of the Fort Scott (Ark.) City Gas Company, of which Mr. L. K. Scofield is President.

WRITING of Fort Scott recalls to mind the fact that Judge J. D. Hill, former owner of the Fort Scott Street Railway Company, says that the system is to be equipped with the Connelly gas motor.

THE Watson Fuel Company, of Portland, Oregon, has been incorporated by Messrs. W. C. Watson, S. Stein, and W. C. Latham. Capital, $25.000.

THE City Council of Newport, Ky., has finally agreed to settle the back bills for public lighting performed by the Newport Light Company. The sum involved is $6,500.

THE Oakland (Cal.) Gas Company is adding to its electric lighting plant.

Recent Patent Issues.

The following list of recent patents relating to the gas interests is specially reported by Franklin H. Hough, solicitor of American and foreign patents, 925 F street, N. W., Washington, D. C.

ISSUE OF JULY 23, 1889.

407,656. Gas Burner, Regulating. J. G. Hawkins and J. Barton, Peterborough, Northampton county, England.
407,323. Gas Burning Device. J. P. Barker, Springfield, Mass.
407,320. Gas Engine. C. W. Baldwin, Yonkers, N. Y.
407,321. Gas Engine. C. W. Baldwin, Yonkers, N. Y.
407,645. Gas Governor or Regulator. W. H. Downing, Goodell, Pa.

ISSUE OF JULY 30, 1889.

408,051. Gas Burner, Incandescent. J. L. Stewart, Philadelphia, Pa.
407,818. Gas, Charging Liquids with. C. A. Catlin, Providence, R. I.
407,961. Gas Engine and Carbureter Combined. L. F. McNett, Yonkers, N. Y.
408,071. Gas Governor. H. J. Bell, Gloucester City, N. J.
408,073. Gas Heating Burner. H. J. Bell, Gloucester City, N. J.
408,137. Gas Motor Engine. J. J. Purnell, Lambeth county, Surrey, England.
407,936. Gas Washing Apparatus. E. Ledig, Chemnitz, Saxony, Germany.

The Market for Gas Securities.

The market for city gas shares continues dull and restricted, although the undertone is in line with firmness. Consolidated is at 86 bid; while Mutual more than holds its own. There was some inquiry for Equitable, but we are not cognizant of any actual transfers, purchasers not being willing to trade at higher than 120, whereas holders insist on at least three points advance. In Brooklyn lethargy and weakness are the rule, almost all classes of shares being from 2 to 3 points lower than our last advices.

It is said that an opposition company has been formed for Flatbush, but we fail to see how investors can look upon such a project with favor equal to placing their money in such a venture. Opposition for North Hudson, N. J., is also named amongst the probabilities. Chicago Trusts are at 58¼, and Baltimore Consolidated is at 45½. There is no change in the general situation, which is favorable to the investor.

Advertisers Index.

GAS ENGINEERS. Page

Jos. R. Thomas, New York City ... 188
Wm. Henry White, New York City ... 179
Wm. Mooney, New York City ... 188
William Gardner, Pittsburgh, Pa ... 188
Fred. Bredel, N. Y. City ... 187

CHEMISTS.

Durand Woodman, New York and Newark, N. J ... 177

PROCESSES.

National Gas Light and Fuel Co., Chicago, Ills ... 182
Bartlett, Hayward & Co., Baltimore, Md ... 189
Wm. Henry White, N. Y. City ... 179
United Gas Improvement Co., Phila., Pa ... 181
Henry Pratt & Co., Chicago, Ill ... 190

GAS AND WATER PIPES.

Gloucester Iron Works, Phila., Pa ... 188
Meilert Foundry and Machine Co., Reading, Pa. (John Fox, Selling Agent, N. Y.) ... 188
Ohio Pipe Co., Columbus, Ohio ... 188
M. J. Drummond, New York City ... 188
R. D. Wood & Co., Phila., Pa ... 190
Warren Foundry & Machine Co., New York City ... 188
Donaldson Iron Co., Emaus, Pa ... 188
Dennis Long & Company, Louisville, Ky ... 188

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City ... 191
Continental Iron Works, Greenpoint, L. I ... 191
Delly & Fowler, Phila., Pa ... 191
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 190
Stacey Mfg. Co., Cincinnati, Ohio ... 191
Bartlett, Hayward & Co., Baltimore, Md ... 189
Morris, Tasker & Co., Limited, Phila., Pa ... 189
Davis & Farnum Mfg. Co., Waltham, Mass ... 179
R. D. Wood & Co., Phila., Pa ... 190
Bouton Foundry Co., Chicago, Ills ... 191
Smith & Sayre Manufacturing Co., New York City ... 191
Fred. Bredel, N. Y. City ... 187
United Gas Improvement Co., Phila., Pa ... 181
Henry Pratt & Co., Chicago, Ill ... 190
National Gas Light and Fuel Co., Chicago, Ills ... 182

INCLINED RETORTS.

Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 147

GASHOLDER TANKS.

W. C. Whyte, New York City ... 182
J. P. Whittier, Brooklyn, N. Y ... 178

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass ... 177

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J ... 186
B. Kreischer & Sons, New York City ... 186
Adam Weber, New York City ... 186
Laclede Fire Brick Manuf'g Co., St. Louis, Mo ... 186
Brooklyn Retort and Fire Brick Works, Brooklyn, N. Y ... 186
Borgner & O'Brien, Phila., Pa ... 186
James Gardner, Jr., Pittsburgh, Pa ... 186
Henry Maurer & Son, New York city ... 187
Chicago Retort and Fire Brick Co., Chicago, Ills ... 187
Baltimore Retort and Fire Brick Co., Baltimore ... 186
Oakhill Gas Retort and Fire Brick Co., St. Louis, Mo ... 186
Emil Lenz, New York City ... 186

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md ... 189
Fred. Bredel, New York City ... 187
Chicago Retort and Firebrick Co., Chicago, Ills ... 187
Wm. Henry White, N. Y. City ... 179
J. H. Gautier & Co., Jersey City, N. J ... 187

SCRUBBERS AND CONDENSERS.

G. Shepard Page, New York City ... 148
R. D. Wood & Co., Phila., Pa ... 190

GAS GOVERNORS.

Connelly & Co., New York City ... 183
Fred. Bredel, N. Y. City ... 187
Friedrich Lux, London, England ... 178

SELF-SEALING MOUTHPIECE DOORS.

Smith & Sayre Mfg. Co., New York City ... 183

TAR AND CARBONIC ACID EXTRACTOR.

Geo. Shepard Page, N. Y. City ... 180

CEMENTS.

C. L. Gerould & Co., Brooklyn, N. Y ... 186

GAS ENRICHERS.

Standard Oil Co., Cleveland, Ohio ... 192

GAS METERS.

Harris, Griffin & Co., Phila., Pa ... 194
American Meter Co., New York and Philadelphia ... 195
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa ... 195
Helme & McIlhenny, Phila., Pa ... 195
D. McDonald & Co. Albany, N. Y ... 195
Nathaniel Tufts, Boston, Mass ... 194
Maryland Meter and Manufacturing Co., Baltimore, Md ... 194
John Hillen, Brooklyn, N. Y ... 195

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind ... 178
Smith & Sayre Manufacturing Co., New York City ... 191
Wilbraham Bros., Philadelphia, Pa ... 183
Connelly & Co., New York City ... 183

GAS COALS.

Penn Gas Coal Co., Phila., Pa ... 193
Perkins & Co., New York City ... 192
Newburgh Orrel Coal Co., Baltimore Md ... 193
Despard Coal Co., Baltimore, Md ... 193
Chesapeake and Ohio R.R. Coal Agency, N. Y. City ... 193
Westmoreland Coal Company, Phila., Pa ... 193
J. & W. Wood, New York City ... 192

CANNEL COALS.

Perkins & Co., New York City ... 192
J. & W. Wood, New York City ... 152

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y ... 184
John McLean, New York City ... 184
Chapman Valve Manufacturing Co., Boston, Mass ... 184
R. D. Wood & Co., Phila., Pa ... 190

GAS ENGINES.

Schleicher, Schumm & Co., Phila., Pa ... 164
Clerk Gas Engine Co., Phila., Pa ... 184
Van Duzen Gas Engine Co., Cincinnati, Ohio ... 184

ENGINES AND BOILERS.

Jarvis Engineering Co., Boston, Mass ... 183
Ball Engine Co., Erie, Pa ... 178
Westinghouse Machine Co., Pittsburgh, Pa ... 194

GAS LAMPS.

G. Shepard Page, New York City ... 134
Standard Gas Lamp Co., Phila., Pa ... 178
Welsbach Incandescent Gas Light Co., Phila., Pa ... 179

PURIFIER SCREENS.

John Cabot, New York City ... 184
Geo. A. Mills, Baltimore, Md ... 184

GAS STOVES.

American Meter Co., New York and Philadelphia ... 185
The Goodwin Gas Stove and Meter Co., Phila. Pa ... 196

STREET LAMPS.

J. G. Miner, Morrisania, New York City ... 146
Bartlett Street Lamp Man'fg Co., New York City ... 178

BURNERS.

C. A. Gefroner, Phila., Pa ... 192

STEAM BLOWER FOR BURNING BREESE.

H. E. Parson, New York City ... 152

PURIFYING MATERIAL.

Connelly & Co., New York City ... 183
Friedrich Lux, London, England ... 178
Edgewater Lime Works, Edgewater, N. J ... 178

COKE CRUSHER.

C. M. Keller, Columbus, Ind ... 193

ELECTRICAL APPARATUS.

Wm. Henry White, N. Y. City ... 179

WANTED,

Gas Engine,

Second-hand 10-horse power Otto Gas Engine, guaranteed to be in good condition. Address, giving terms, etc.,

739-1 ELGIN AMERICAN GAS CO., Elgin, Ill.

6 PER CENT.

First Mortgage Bonds

ON GAS WORKS

SITUATED IN GROWING WESTERN TOWNS.

Principal and Interest Guaranteed.

INTEREST SEMI-ANNUALLY.

For sale by the undersigned, who will furnish all necessary information regarding them.

JOS. R. THOMAS, 42 Pine St., N. Y. City.

Position Wanted

As Superintendent of Gas Works,

By gentleman of large experience in management of gas works. A good designer and man of inventive abili y. Has had charge for nearly 10 years of one of the most complete works in the country. For reliability, habits, etc., refers to H. K. List, Prest. City Bank and Board of Gas Trustees, City of Wheeling, W. Va.

739-4 Address "PRACTICAL," care this Journal.

Position Desired.

A young Gas Engineer desires a permanent position as

Engineer or Superintendent of a Medium-Sized Gas Works.

Thoroughly versed in all branches of manufacture and distribution of gas and the construction of gas works. Highly recommended. Address "ENGINEER," care this Journal.

737-5

Situation Wanted as Manager or Supt.

A young man who is a hustler in the gas business desires a situation as Superintendent or Manager of a Gas Works. Has had experience in the manufacture and distribution of Coal and Water Gas, and the treatment of Natural Gas by the McKay-Critchlow process. Good references furnished and satisfaction guaranteed. Address "D.," care this Office.

FOR SALE,

CHEAP FOR CASH, TO CLOSE AN ESTATE,

A Controlling Interest in both Gas and Electric Plants in a Growing Suburb of New York City.

A well-established, paying business, with a very promising future. For particulars address

735-tf "ESTATE," care this Office.

GEROULD'S

System Gas Bookkeeping.

Approved and adopted by many of the prominent Gas Engineers of the Country.

Sample Sheets and Price-List furnished free on application to

L. P. GEROULD, - - Mendota, Ill.

DURAND WOODMAN, Ph.D.

Analytic and Technical

CHEMIST.

Analyses of Coals, Oils, Lubricants. Experimental Investigations for Inventors.

Laboratory, 494 Broad Street, Newark, N. J.
New York Office, (4 to 5 P.M.) **52 Broadway.**

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO
ERIE PA.

No. 29 Champion.

PHILADELPHIA. NEW YORK. CHICAGO.

STEPHEN A. MORSE, President. EDWIN F. MORSE, Secretary.
GODFREY REBMANN, Vice-Pres. CARLTON M. WILLIAMS, Treas.

STANDARD GAS LAMP CO.,

Main Office, 411 Cherry St. Factory, 1101, 1103, 1105 Frankford Av.

PHILADELPHIA, PA.

It is to the interest of Gas Companies and Cities to double the efficiency of the light on streets by using Dyott's Patent "CHAMPION" LAMPS. They save 50 per cent. over others in cost of repairs, are ornamental, and indestructible except by violence.

Our Patent System of Instantaneously Lighting Gas (without electricity), for Railroad Depots is unequaled.

Dyott's High Candle Power Burner is a very superior lamp where a concentrated and brilliant light is wanted in Hotels, Stores, Depots, etc.

Special Drawings furnished and Estimates cheerfully given, either from Architects', Engineers', or our Draughtmen's Plans.

We manufacture every description of Plain and Ornamental Lamps, Posts, Brackets, Clusters, etc. Correspondence solicited.

EDGEWATER LIME WORKS

Chas. F. McKenna, Proprietor.

SHELL LIME.

Lime by the Cargo for Gas Purification.

EDGEWATER, BERGEN CO., N. J.

Write for Testimonials and Prices.

FRIEDRICH LUX,

Ludwigshafen am Rhein and London.

Lux Mass

GAS GOVERNORS,

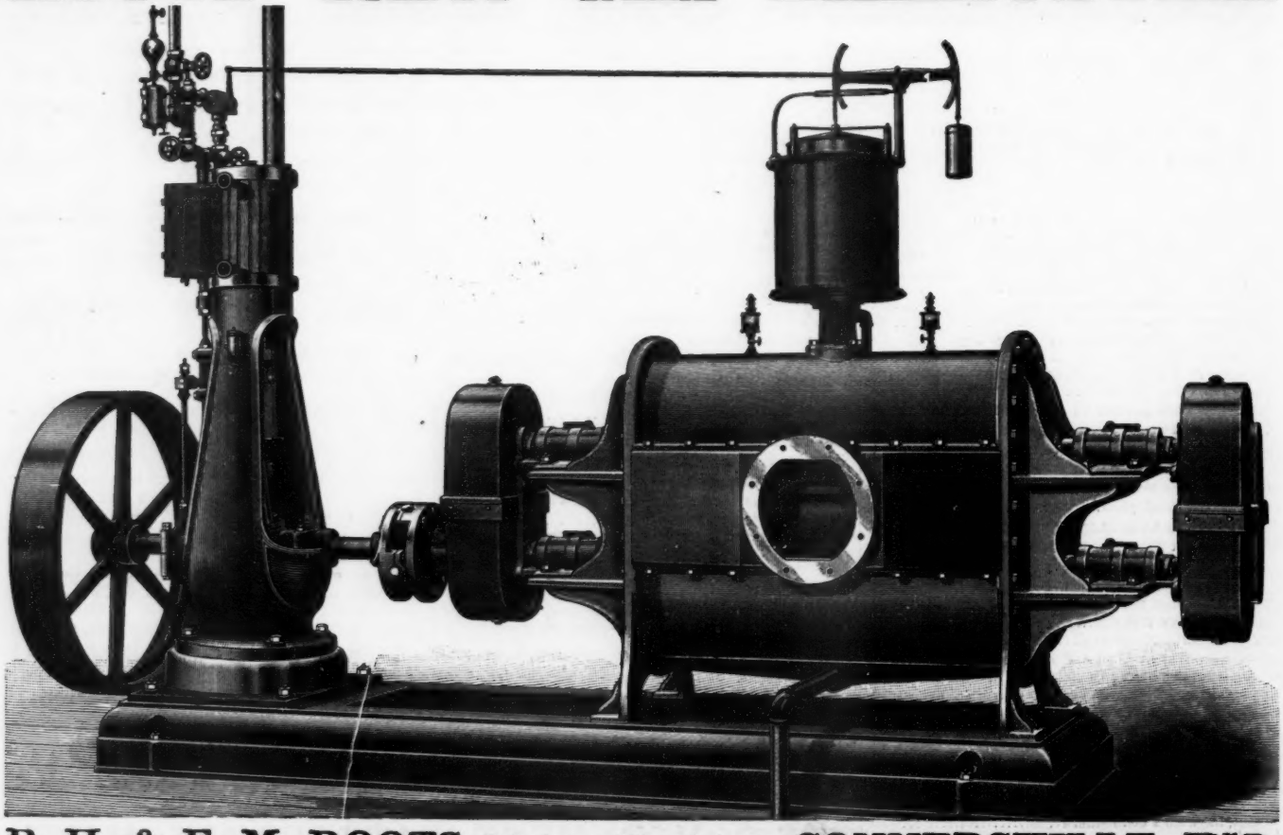
Gas Balance.

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, - - 499 Wythe Av., Brooklyn, N. Y.

ROOTS' NEW GAS EXHAUSTER.



P. H. & F. M. ROOTS, Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, Gen. Agt., 22 Cortlandt St., N. Y. COOKE & CO., Selling Agts., 22 Cortlandt St., N. Y.

Welsbach System of Incandescent Gas Lighting.

OFFICE, DREXEL BUILDING, PHILA., PA.

The Welsbach Light is in successful operation on Artificial Gas in the following places: St. Albans, Vt.; Boston, Chicopee, Lowell, and Springfield, Mass.; Danbury, Hartford, New Haven, Norwich, Rockville, South Manchester, Waterbury, Meriden, Bridgeport, and Willimantic, Conn.; Bristol and Newport, R. I.; New York City; Camden, Jersey City, Newark, and Trenton, N. J.; Phila., Pa.; Washington, D. C.; Goldsboro, N. C.; New Orleans, La.; Pensacola, Fla.; Toledo, O.; Oshkosh, Wis.; Omaha, Neb.; San Francisco, Cal.; St. Paul and Minneapolis, Minn.

The Welsbach Light is also used very extensively with Natural Gas in the following places: Beaver County, Belle Vernon, Braddock, Bridgeport, Brownsville, Butler, Camp Copeland, Connellsville, Clarion County, Erie, Fayette City, Ford City, Kittanning, Manorville, Meadville, Millerstown, Mills Station, Mount Jewett, New Castle, Oil City, Pittsburgh, Saltsburg, Scottdale, Tarentum, Titusville, Uniontown, Westmoreland County, and Worthington—all in Pennsylvania; Bellaire, East Liverpool, Findlay, Lancaster, Painesville, and Youngstown, O.; Indianapolis and Muncie, Ind.; Buffalo, Jamestown, and Olean, N. Y.; Morgantown, W. Va.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

Erection and Extension of Gas, Water, and Electric Light Works.

SOLE REPRESENTATIVE OF THE

McILHENNY REGENERATOR FURNACE PATENTS

And the Martin Water Gas Process.

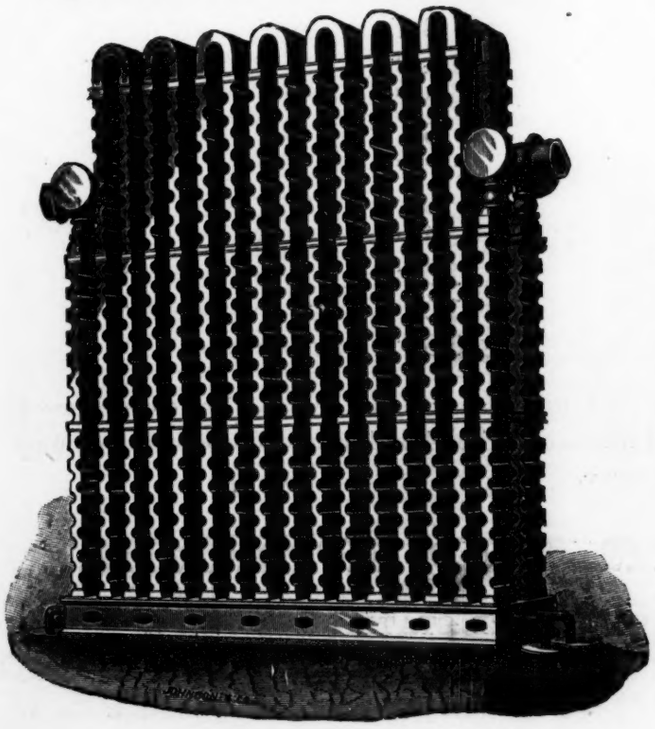
Edison Incandescent and American Arc Electric Light Plants Installed.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited. Plans and Estimates Furnished.

F. J. DAVIS & J. R. FARNUM,

TRUSTEES AND AGENTS FOR THE

SINUOUS FRICTION CONDENSER.



We desire to draw the attention of the gas community to the merits of the SINUOUS FRICTION CONDENSER. Companies intending to introduce new condensers into their works will do well to confer with us and examine plans and estimates before contracting for any other pattern The FRICTION CONDENSER is now in use at the gas works located in the following places:

Portland, Me.	Brookline, Mass.	Pawtucket, R. I.	Fredericton, N B.
Newport, R. I.	Chelsea, Mass.	Jamaica Plain, Mass.	St. John, N. B.
Gloucester, Mass.	Woburn, Mass.	Attleboro, Mass.	Paterson, N. J.
Newton & Watertown, Mass.	Peoria, Ill.	Calais, Me.	Dover, N. H.
	Clinton, Mass.	Fall River, Mass.	Waltham, Mass,
	Nassau Works, Brooklyn, N. Y.		

DAVIS & FARNUM MFG. CO.

MANUFACTURERS OF

Gas and Water Pipes,

AND

GAS AND WATER MACHINERY

OF THE MOST APPROVED PATTERN.

Also, Gasholders and Iron Roofing.

Orders from Gas and Water Companies promptly attended to

WALTHAM, MASS.

Office, Room 55 Mason Building, 70 Kilby Street, Boston

THE
WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, five years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. It is only necessary to give here a partial list in order to convince any intelligent American Gas Engineer that this machine must have succeeded fully in accomplishing the desired results.

The following Engineers have personally given permission to refer to them:

G. C. Trewby, Esq., Engineer-in-Chief of the Gas Light and Coke Co., London. The manufacturing plant at Beckton is built in complete sections of 3,000,000 cubic feet capacity each. A Walker Tar Extractor has been fitted to each one of these sections. This was done after a long and thorough trial on one of its sections. The Tar Extractor has been supplied to other works of the Gas Light and Coke Co., including those of which John Methven, Engineer of the Gas Light and Coke Co. at the Nine Elms Station, is in charge. Also to G. E. Stevenson, Peterborough Gas Works; B. Green, Mitcham and Wimbledon Gas Works; W. H. Smith, Bedford Gas Works; F. Linging, Norwich Gas Works; J. T. Browning, Colchester Gas Works; S. B. Darwin, Portsmouth Gas Works; J. McCrae, Dundee Gas Works; W. J. Wells, Stamford Gas Works; J. M. Darwin, Longton Gas Works; J. Paterson, Warrington Gas Works; and J. Coulter, of the Dundalk Gas Works. All of the foregoing gas works are located in Great Britain.

Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers."

I have taken the Agency for the United States for this apparatus, and am now prepared to make contracts to erect it on the premises of any Gas Company. It would be manufactured in the following sizes:

No. 1,	50,000	to	100,000	cu.	ft.	per	24	hrs.,	3	ft.	square, 5 ft. deep.
No. 2,	"	"	125,000	"	"	"	4	"	"	"	"
No. 3,	"	"	250,000	"	"	"	5	"	"	"	"
No. 4,	"	"	500,000	"	"	"	6	"	"	"	"
No. 5,	"	"	750,000	"	"	"	7	"	"	"	"
No. 6,	"	"	1,000,000	"	"	"	8	"	"	"	"
No. 7,	"	"	1,250,000	"	"	"	9	"	"	"	"
No. 8,	"	"	1,500,000	"	"	"	10	"	"	"	"
No. 9,	"	"	2,000,000	"	"	"	12	"	"	"	"
No. 10,	"	"	3,000,000	"	"	"	15	"	"	"	"

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results will be guaranteed in every instance.

GEO. SHEPARD PAGE,

SOLE AGENT FOR THE UNITED STATES,

No. 69 Wall Street, - - - New York.

UNITED

GAS IMPROVEMENT CO.

DREXEL BUILDING, CHESTNUT AND FIFTH STREETS,

PHILADELPHIA.

OFFICERS:

GEORGE PHILLER, President.
W. W. GIBBS, Vice-President.
SAM'L T. BODINE, Gen'l Manager.
H. H. EDGERTON, Chemist and Engineer.
EDWARD C. LEE, Sec'y and Treasurer.
ALEX. C. HUMPHREYS, Gen'l Supt.
WALTON CLARK, Ass't Gen'l Supt.
RANDAL MORGAN, Gen'l Counsel.

DIRECTORS:

GEORGE PHILLER, JAMES A. WRIGHT, S. A. CALDWELL,
WM. W. GIBBS, HENRY C. GIBSON, WM. M. SINGERLY,
THOMAS DOLAN, SAM'L T. BODINE, WM. T. CARTER.

BUILDERS, LESSEES AND PURCHASERS OF

GAS WORKS

Orders solicited from Large Cities, Small Towns, Mills, Institutions, from all who want More Light for Less Money.

NATIONAL GAS LIGHT AND FUEL COMPANY,

No. 218 La Salle Street, Chicago.

THE SPRINGER SYSTEM

OF

Fuel and Illuminating Water Gas Works.

REFERENCES.

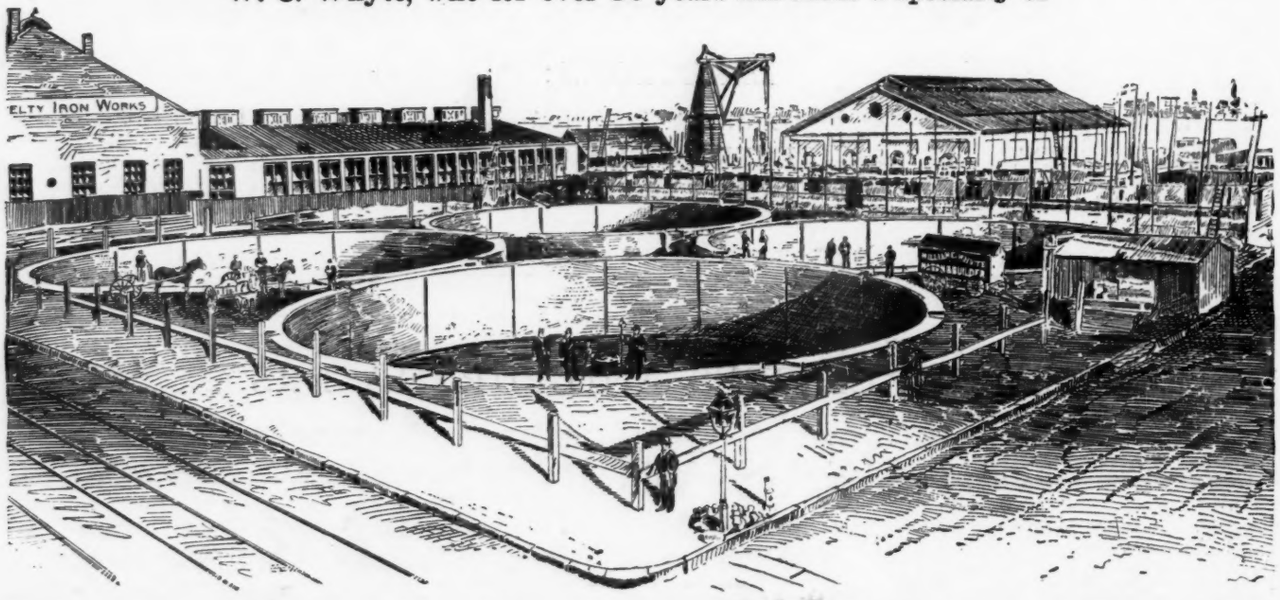
People's Gas Light and Coke Co.	Chicago, Ill.
Illinois Light, Heat and Power Co.	Chicago, Ill
Elgin National Watch Co.	Elgin, Ill.
C. R. I. & P. R. R. Shops	Chicago, Ill.
Decatur Gas Light and Coke Co.	Decatur, Ill.
Niles Gas Light Co.	Niles, Mich.
Newton Illuminating Co.	Newton, Kansas.
Wellington Light and Heat Co.	Wellington, Kansas.
Chippewa Falls Gas Light Co.	Chippewa Falls, Wis.
Elkhart Gas Light and Coke Co.	Elkhart, Ind.
Madison City Gas Light Co.	Madison, Wis.
South Bend Gas Light Co.	South Bend, Ind.
Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co.	Salina, Kansas.
The Rathbun Co.	Deseronto, Prov. Ont.
Jefferson City Gas Light Co.	Jefferson City, Mo.
Mankato Gas Light Co.	Mankato, Minn.
Minneapolis Gas Light and Coke Co.	Minneapolis, Minn.
Lima Gas Light Co.	Lima, Ohio.
Bellevue Water and Fuel Gas Light Co.	Bellevue, Campbell County, Ky.
Bucyrus Gas Light and Fuel Co.	Bucyrus, Ohio.
Morris Gas Co.	Morris, Ill.
Los Angeles Gas Co.	Los Angeles, Cal.
San Diego Gas Fuel and Electric Lt. Co.	San Diego, Cal.
Sioux Falls Gas Co.	Sioux Falls, Dak.
Dakota Gas and Fuel Co.	Grand Forks, Dak.
St. Johns Mutual Gas Co.	St. Johns, Mich.
Stillwater Gas Light Co.	Stillwater, Minn.
St. Paul Gas Light Co.	St. Paul, Minn.
Emporia Electric and Gas Light Co.	Emporia, Kas.
Van Wert Gas Light Co.	Van Wert, Ohio.
Lansing Gas Light Co.	Lansing, Mich.
San Francisco Gas Light Co	San Francisco, Cal.
Shelbyville Gas Light Co.	Shelbyville, Ind.
Great Falls Gas Light Co.	Great Falls, N. H.
Belleville Gas Co.	Belleville, Ontario.
Rochester Light and Fuel Co	Rochester, Minn.
Northwestern Gas Light and Coke Co.	Evanston, Ill.
Lincoln Gas Light Co.	Lincoln, Neb.
Davenport Gas Light Co.	Davenport, Iowa.
Municipal Gas Co.	Albany, N. Y.
Alliance Gas Light Co.	Alliance, Ohio.
*Chicago Gas Light and Coke Co.	Chicago, Ill.
*New Gas Light Co.	Janesville, Wis.
*Joliet Gas Co.	Joliet, Ills.

* Building.

CUARANTEED ESTIMATES of Cost of Gas Furnished on Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City

CONNELLY & CO.,

SOLE MANUFACTURERS OF THEIR PATENTED SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying agent ever offered as a substitute for lime. Now used *in every State in the Union*, and purifying daily over *thirty-five million cubic feet.* Should be used in every gas works. Its own saving will pay for it many times over.

AUTOMATIC GOVERNOR. Has been on the market but *three years*, and in that time has been introduced *more generally* than any invention ever designed for use in gas works. Over *two hundred* of them now in use. Sensitive; reliable; perfectly automatic; reduces leakage; satisfies consumers, and gives great relief to the Manager. No gas works is *complete* without one of these machines.

STEAM JET EXHAUSTER. Designed particularly for small works Combines Exhaust Tube, Steam Governor Gas Compensator, and Bye-Pass Valves in the most compact form possible; occupies but little space; uses very little steam; operated by ordinary workmen; saves formation of carbon in retorts; increases yield 10 to 15 per cent. Specially adapted for *mixing air* with oil gas. *No works* too small to use them profitably.

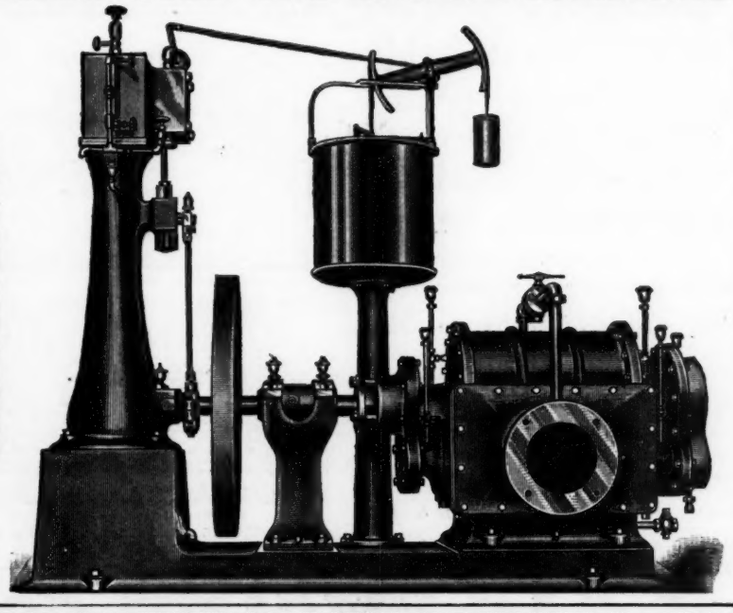
Prices given on all our specialties *delivered at any point in the United States.* Correspondence solicited.

CONNELLY & CO., No. 177 Broadway, New York City.

WILBRAHAM

GAS EXHAUSTER AND ENGINE COMBINED.

WILBRAHAM BROS., PHILADELPHIA, PA.



JARVIS ENGINEERING CO.,

61 Oliver St., Boston, Mass.

CONTRACTORS FOR ERECTING

COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

REFERENCES.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Practical Electric Lighting

By A. BROMLEY HOLMES, A.M.I.C.E.

With 87 Illustrations. Third Edition. **Price, $1.00.**

Electric Light Primer.

By CHARLES L. LEVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 50 cents.

A. M. CALLENDER & CO., 42 Pine St., N.Y.

THE BRENNER SELF-SEALING RETORT DOOR.

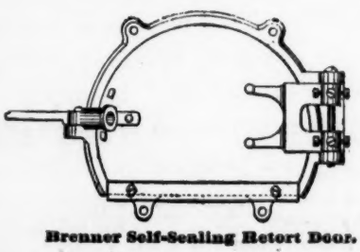
Simple, Strong, and Durable.

CLOSES ABSOLUTELY TIGHT & IS LOCKED BY A CAM LEVER. ALL NECESSARY ADJUSTMENT FOR WEAR PROVIDED.

BUILT BY

SMITH & SAYRE MFG. CO.,

No. 245 Broadway, - - - - New York City.



Brenner Self-Sealing Retort Door.

WILLIAM B. LUNDIE, Superintendent of the 42d Street Station of the Consolidated Gas Company, of New York, writes, under date of Jan. 4, 1889:

"We have 320 Brenner Self-Sealing Lids in use at this Station, built by the Smith & Sayre Mfg. Co. They require very little attention, and are the best of the kind that I have seen, giving entire satisfaction."

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: Indian Orchard, Mass.

TREASURER'S OFFICE: 72 Kilby & 112 Milk Sts, Boston, Mass.

GEO. SHEPARD PAGE,

No. 69 Wall Street, N. Y. City.

REPRESENTING

THE BOWER GAS LAMP.

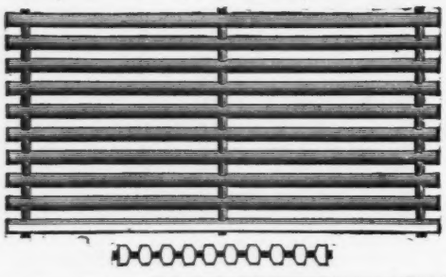
C. & W. Walker's Carbonic Acid & Tar Extracting Washer

B. DONKIN & CO.'S PAT. IMP. GAS VALVE.

Young & Beilby's Patents. Henry Aitkin's Patents.

R. P. SPICE, London, Eng. HENRY SIMON, Manchester, Eng.

MILLS' REVERSIBLE LIME TRAY,



AND

WOODWORK

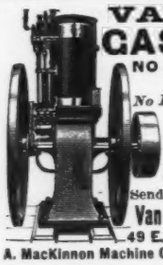
Of Every Description

NEEDED BY GAS WORKS.

SEND FOR CIRCULAR AND PRICE LIST TO

GEORGE A. MILLS,

No. 20 East Barre St., Baltimore, Md.



VAN DUZEN GAS ENGINE

NO BOILER. NO COAL. NO ENGINEER.

No Extra WATER RENT or INSURANCE.

INSTANTLY STARTED.

DURABLE, RELIABLE, SAFE and ECONOMICAL.

Send for description and prices.

Van Duzen Gas Engine CO.,

49 E. 2nd St., CINCINNATI, O.

J. A. MacKinnon Machine Co., Agts., 22 Warren St., N.Y.

The Management of Small Gas Works.

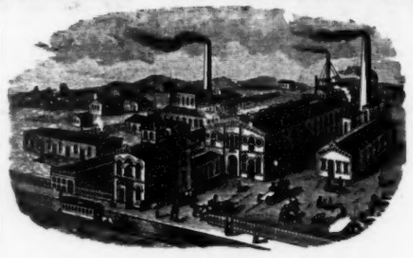
BY C. J. R. HUMPHREYS.

Price, $1.

Orders to be sent to **A. M. CALLENDER & CO.,**

43 PINE STREET, NEW YORK.

LUDLOW VALVE MFG. CO.

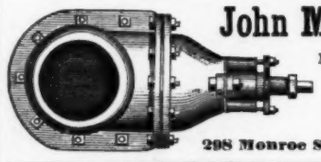


OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av., TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants. Send for Circulars.

Valves.—Double and Single Gate, 4 in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.



John McLean

Man'facturer

GAS VALVES.

298 Monroe Street, N. Y.

SPECIAL TRAYS FOR IRON SPONGE OR OXIDE OF IRON.

CHURCH'S TRAYS A SPECIALTY.

REVERSIBLE-STRONGEST-MOST DURABLE-MOST EASILY REPAIRED.

JOHN CABOT. TRAYS FOR GAS WORKS.

306-310 ELEVENTH AVENUE, NEW YORK.

WE ALSO MAKE THE CHEAPEST AND STRONGEST REVERSIBLE BOLTED TRAYS IN THE MARKET.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

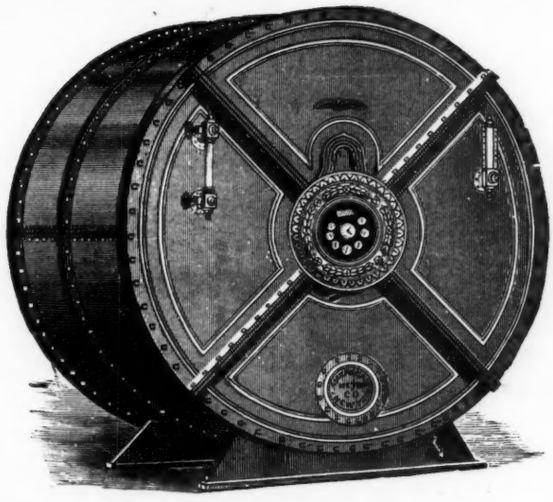
Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.,

MANUFACTURERS OF

GAS METERS AND GAS STOVES.



We would call the attention of Gas Engineers to the

PARKINSON THREE-PARTITION DRUM FOR STATION METERS.

This Drum insures an increased capacity of 25 per cent., and, in connection with Lloyd's Patent Stationary Shaft, the minimum of friction and consequent ease in working.

GAS COOKING STOVES.

The large number of our ECONOMY GAS COOKING STOVES AND RANGES in successful operation and the continued demand for them, warrants us in asking our patrons to place their orders with us at as early a date as possible, in order to avoid delay in shipping.

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. **Arch and Twenty-second St., Phila.**

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.

No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York City.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

J. H. GAUTIER. C. E. GREGORY. C. E. GAUTIER.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS

ADAM WEBER.

CLAY GAS RETORTS

AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y.

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON.

Office, Rooms 19 & 20, Lewis Block, PITTSBURGH, PA, P. O. Box 373.

Fire Clay Goods for Gas Works.

CHAS. H. SPRAGUE & SON, No. 70 KILBY STREET, BOSTON, MASS., Agents for the New England States.

2 & 4 Stone St., **EMIL LENZ,** New York City.

Clay Gas Retorts (Enameled), Fire Brick, Blocks, and Tiles.

MUNICH REGENERATIVE AND HALF-REGENERATIVE BENCHES.

Portland Cement, Fire Cement, Retort Enamel, Retort Cement, etc., etc. Correspondence Respectfully Solicited.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD & CO.,

5 & 7 Skillman St., Brooklyn, N. Y.

Western Agent, H. T. GEROULD, Mendota, Ill.

GAS vs. ELECTRIC LIGHT.

We would invite attention to the able and exhaustive argument of General A. Hickenlooper, President of the Cincinnati Gas Light and Coke Company, contained in a handsome pamphlet of 96 pages, entitled

"EDISON'S INCANDESCENT ELECTRIC LIGHTS FOR STREET ILLUMINATION. REPORT OF AN ARGUMENT DELIVERED BY A. HICKENLOOPER BEFORE THE COMMITTEE ON LIGHT, MUNICIPAL COUNCIL, CITY OF CINCINNATI, JULY 22, 1886."

This is a subject of special interest to all Gas Light Companies.

Prices.

25 copies.....	$7.50	100 copies.....	$22.50
50 copies.....	12.50	250 copies.....	50.00

A sample copy will be sent by mail on receipt of 50 cts.

A. M. CALLENDER, & CO., 42 PINE ST., N. Y. CITY.

Parker-Russell Mining and Mfg. Co.,

City Office: { American Central Building, Broadway & Locust, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of materials for

GAS COMPANIES.

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying.

We furnish and build Half-Depth or Full REGENERATOR FURNACES of different kinds and most approved styles.

Correspondence solicited.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles,

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

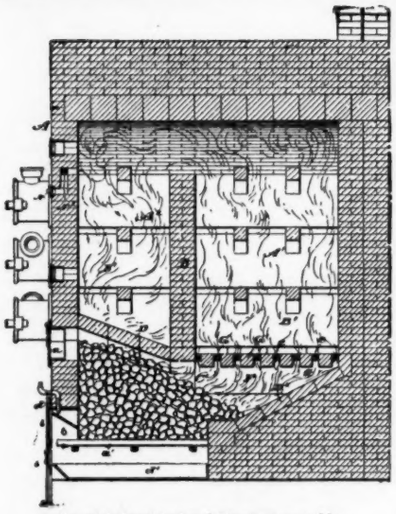
Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

FRED. BREDEL,

CONTRACTOR FOR THE COMPLETE

Erection and Equipment of Gas Works.

SOLE PROPRIETOR OF THE

KLOENNE PATENTS

FOR NORTH AMERICA.

REGENERATIVE FURNACES.

(900 Retorts are now fired in America by the Kloenne-Bredel System.)

SELF-SEALING MOUTHPIECES.

(Over 800 Now in Use.)

Standard Condensers. Washer-Scrubbers.

TAR WASHERS FOR WATER GAS PLANTS.

(In use in the works of the Chicago Gas Lt. Co.)

GASHOLDERS.

Bredel's Automatic Gas Governor.

Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J.; Mr E. G. Cowdery, Milwaukee, Wis.; and Mr. Theo. Forstall, Chicago, Ills. For further infomation, address

FRED. BREDEL,

No. 208 East Seventeenth Street, N. Y. City.

CHICAGO RETORT AND FIRE BRICK COMPANY,

GEO. C. HICKS. President. 45th, Clark and La Salle Streets, Chicago, Ill. CHAS. A. REED, Sec. & Treas.

Manufacturers of Standard Clay Retorts, Gas Works Tiles and Settings, Fire Bricks, Ground Fire Clay, Fire Mortar, Blocks for Locomotives, Cupolas, Boilers, Ovens, etc.

The Hicks Regenerative Furnace.

FOR LARGE OR SMALL GAS WORKS. NO ROASTING PITHOLE FOR THE STOKERS. NO EXCAVATION BELOW THE ORDINARY ASHPAN.

This Bench is applicable everywhere as a practical adaptation of the Regenerative and Recuperative System, giving, at a moderate cost, a very high efficiency, with great saving of labor and coke. Even with an isolated bench we guarantee a production of 42,000 ft. per bench of 6's, 14″×26″×9′, on 30 per cent. of coke, *hot* or *cold*, with probable production of 48,000 ft. if desired. We also construct the highly successful *Two-Story Regenerative Benches* on the plans of Mr. A. Arndt, Engineer of the Chicago Gas Light and Coke Co. Also, the *Sloping Retort System* of Henry Pratt, Engineer of the Peoples Gas Light and Coke Company, of Chicago.

Fire Clay Materials for Water Gas Cupolas, etc. Special Attention to Making Tiles and Blocks to Order.

Boston Agents, · · FISKE, COLEMAN & CO.

1889 DIRECTORY 1889

OF THE GAS LIGHT COMPANIES of the UNITED STATES & CANADA.

Price, · · · · · · · $3.00.

Orders may be sent to

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

GAS AND WATER PIPES. GAS AND WATER PIPES. ENGINEERS.

SAM'L R. SHIPLEY, Pres.
HENRY B. CHEW, Treas.

JAS. P. MICHELLON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,
GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office, Rooms 61 and 63 Bullitt Building, 131 S. 4th St., Phila., Pa.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM TWO TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

DENNIS LONG & COMPANY,

LOUISVILLE, KY.,

Manufacture Exclusively

CAST IRON GAS & WATER PIPE & SPECIAL CASTINGS

OF ALL SIZES.

King's Treatise on Coal Gas.

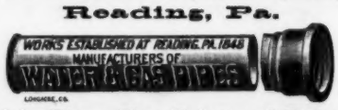
A stan ard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine, and of Gas Cooking and Heating Appliances.

In 3 Vols. Price per Vol., $10. Sold either by Volume or in Sets.

A. M. CALLLENDER & CO., 42 Pine St., N. Y.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wk
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO., Ltd.
and READING FOUNDRY CO., Ltd.,
Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants
Lamp Posts, Retorts, etc.
General Foundry and Machine Work.
JOHN FOX, Selling Agent. 160 Broadway, N.Y.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.
Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.

JOS. R. THOMAS,
No. 42 Pine Street, N.Y. City.
CONSULTING AND CONSTRUCTING
Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,
Either for New Works or Extensions to Old Plants.

WM. MOONEY
(Successor to WM. FARMER)
No. 94 Liberty St., N Y. City.

CONTRACTOR FOR THE ERECTION OF GAS WORKS, OR APPARATUS OF ANY CAPACITY. AGENT FOR WM. FARMER'S PATENTS.
Plans and Specifications Furnished.

WM. GARDNER,
Gas Engineer,
Lewis Block, Room 20, Pittsburgh, Pa.

Those who intend to make alterations in existing gas plants, or who contemplate the erection of new works, will find it to their interest to open correspondence with the above. Plans made and estimates furnished.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

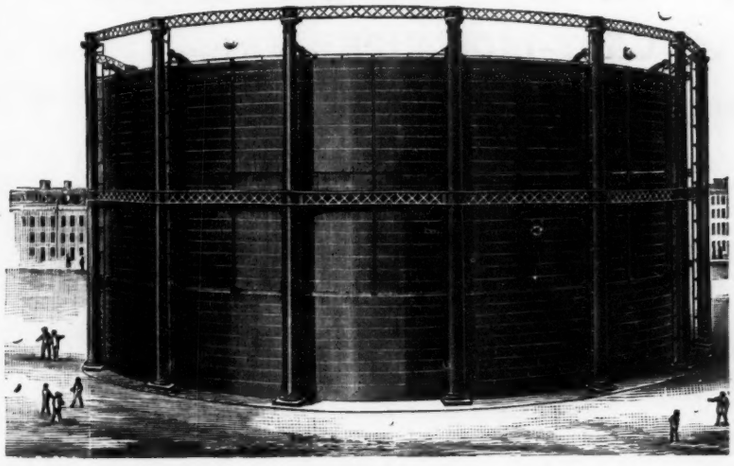
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

HAZELTON BOILERS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

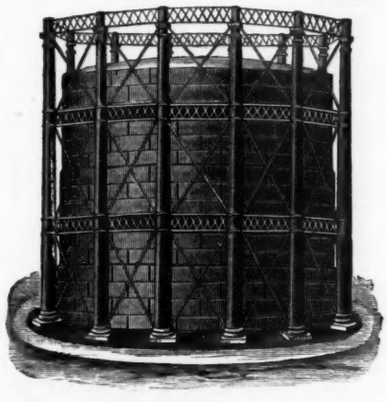
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

WORKS: { MILLVILLE, N. J. / FLORENCE, " / CAMDEN, "

R. D. WOOD & CO.,

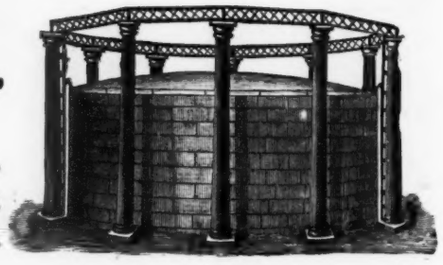
OFFICES: { 400 CHESTNUT ST., PHILADELPHIA.

CAST-IRON PIPE 1½ to 72 Inches in Diameter.

Water Machinery and Gas Apparatus. HEAVY CASTINGS.

HOLDERS, PURIFIERS, FLOORS AND ROOFS,
LAMP POSTS, CONDENSERS, FLANGED PIPE,
VALVES, BENCH WORK, FIRE HYDRANTS,
METER CASES.

Estimates and Specifications for NEW WORKS or EXTENSIONS or ALTERATIONS of OLD ONES.



Plans and Estimates Furnished for New Works or for the Alteration of Old Works.

HENRY PRATT & CO.,

BUILDERS OF THE

PRATT & RYAN WATER GAS GENERATORS,

Arranged to Use Either Crude Oil or Naphtha.

Condensers, Scrubbers, Purifiers, and all Apparatus for Coal or Water Gas.

IRON ROOFS, BOILERS, TANKS, ETC.

Orders and Correspondence Solicited.

Office and Works, 869 to 875 So. Halsted St. CHICAGO, ILL.

KERR MURRAY MANUFACTURING CO.,

ENGINEERS AND CONTRACTORS FOR THE CONSTRUCTION OF

GAS WORKS APPARATUS.

Iron Roofs, Gutters, Retort House Floors, Bench Castings, Regenerator Furnace Castings, Rotary and Steam Jet Exhausters, Annular and Multitubular Condensers, Coil Pipe Condensers, Hot Tar Scrubbers, Tower & Rotary Washers, Purifiers, Center Seals, Patent Four-Way Valve Combination.

Hydraulic Lifts for Purifier Covers, Ash and Southern Pine Reversible Trays, Meter Bye-Passes, Hub and Flange Stop Valves, Lamp Posts, Wrought Iron Oil and Water Tanks, Coal Charging Wagons, Coke Dumping Barrows, Retort House Tools, Steam Engines and Boilers, Combination Pressure Gauges.

Single-Lift and Telescopic Gasholders.

STREET MAIN SPECIALS.

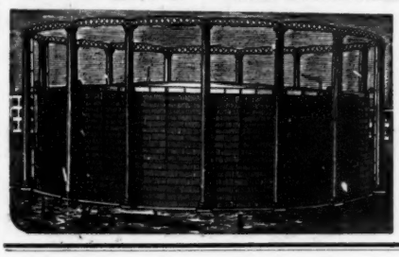
Plans, Specifications and Estimates for New or Rebuilding of Old Works furnished on application. Address all communications to

KERR MURRAY MANUFACTURING COMPANY, - FORT WAYNE, IND.

A. D. CRESSLER, General Manager.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,
(SUCCESSORS TO HERRING & FLOYD)
Oregon Iron Works,
W. 20th & 21st. Sts., bet. 10th & 11th Avs.,
NEW YORK CITY.
Engineers and Contractors
FOR THE
CONSTRUCTION OF GAS WORKS.
MANUFACTURERS OF
All Kinds of Castings and General Ironwork
FOR
GAS APPARATUS.
Bench Castings, Regenerative and Half Regenerative Furnace Castings.
Condensers, Scrubbers, Purifiers, Street Drips and Connections,
Valves,
Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.
Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

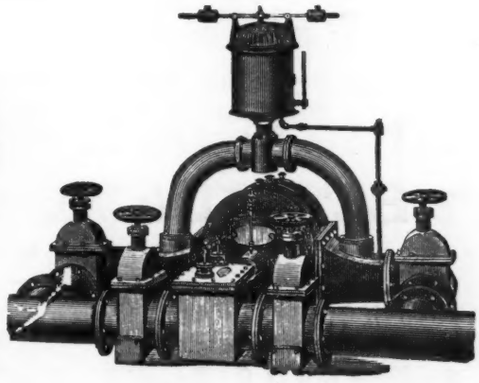
CONTINENTAL IRON WORKS.
THOS. F. ROWLAND, Prest. WARREN E. HILL and CHAS. H. CORBETT, V-Prests. THOS. F. ROWLAND, JR., Sec. & Tr

P. O. Station G., BROOKLYN, N. Y.
ENGINEERS AND MANUFACTURERS OF
Gas Holders
CONDENSERS, SCRUBBERS, VALVES,
PURIFIERS, SELF-SEALING RETORT LIDS
Hydraulic Mains,
And all other articles connected with the manufacture and distribution of Gas.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.
STACEY MFG. CO.,
MANUFACTURERS OF
Single and Telescopic Gasholders,
IRON ROOFS, BRIDGES, LAMP POSTS,
Water and Oil Tanks, Coal Elevator Cars,
COKE CRUSHERS, BENCH CASTINGS,
And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.
Foundry: 33, 35, 37 & 39 Mill Street. Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.
Cincinnati, Ohio.

Bouton Foundry Co.,
FOUNDERS AND MACHINISTS,
CHICAGO, ILL.
Gas Works Apparatus,
PURIFIERS, CONDENSERS,
Bench Work,
SPECIALS, LAMP POSTS,
SCRUBBERS,
Iron Roofs and Floors.
Plans and Estimates furnished for new works or extensions of old works.

1842. **DEILY & FOWLER,** 1889.
Laurel Iron Works.
Address, No. 39 Laurel Street, Philadelphia, Pa.
BUILDERS OF
GASHOLDERS,
Single and Telescopic.
Holders Built 1884 to 1888, Inclusive:

Newport, R. I.	Long Island City, N. Y.	Port Chester, N. Y.	Malden, Mass.	West Chester, Pa. (2d
Portland, Oregon.	Macon, Ga.	New Rochelle, N. Y.	Paducah, Ky.	Lancaster, Pa. (3d)
Allegheny, Pa. (2d.)	York, Pa.	Salem, N. J. (3d)	Norwich, Conn.	Facony, Pa. (two)
Atlanta, Ga. (2d.)	Chester, Pa.	Omaha, Neb. (2d)	Seattle, W. T.	Mount Vernon, N. Y.
N.Y.City (Central Gas Co)	Hazleton, Pa. (2d.)	Lynn, Mass. (2d)	San Diego, Cal.	Binghamton, N. Y.
Lynchburg, Va. (2d.)	Staten Island, N. Y.	Little Rock, Ark.	Northern Gas Lt. Co., of	Concord, N. H.
Saylesville, R. I.	Saugerties, N. Y.	Irvington, N. Y.	New York. N. Y.	Dover, Del. (2d)
Rondout, N. Y.	Clinton, Mass. (Lan. Mills)	South Boston, Mass.	Westerly, R. I.	Calais, Me.
Atlantic City, N. J.	Chattanooga, Tenn.	Rye, N. Y. (2)	Willimantic, Conn	New London, Conn. (2d)
Augusta, Ga.	Galveston, Texas. (3d.)	Woodstock, Ont.	Montclair, N. J.	West Chester, N. Y.
Waltham, Mass. (2)	Omaha, Neb.	Malden, Mass.	Attleboro, Mass.	Bay Shore, L. I.
Mahanoy City, Pa.	Fort Plain, N. Y.	Staten Island, N. Y. (2d)	Santa Cruz, Cal.	Washington, D. C.
New Castle, Pa.	Brunswick, Ga.	Woodstock, Ont.	Erie, Pa. (3d)	

SMITH & SAYRE MFG. COMPANY,
G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.
Machinery & Apparatus for Gas Works
Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at **SCOTT HAVEN, PA.**, in the center of the Youghiogheny Gas Coal District, and produces the **ONLY RELIABLE YOUGHIOGHENY COAL** for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

Also, SOLE AGENTS for the

BRECKENRIDGE CANNEL,

OF KENTUCKY.

Within the past two years we have delivered this Cannel to over **ONE HUNDRED COMPANIES IN THIRTY-THREE DIFFERENT STATES,** and it is now in use in some of the large Gas Works

On the Continent and in South America,

where it successfully competes with the Australian Shale. It is the **ONLY AMERICAN GAS CANNEL** of sufficiently high grade to warrant **EXPORTATION TO EUROPE AND SOUTH AMERICA,** and it is the only economical substitute for **OIL OR NAPHTHA.** **ONE GROSS TON** will produce

10,000 Cubic Feet of 75 Candle Gas,
or 12,500 " " 60 " " } equal to { **750,000 Candle Feet of Gas, and 26 Bushels of merchantable Coke weighing 900 Pounds**
or 15,000 " " 50 " "

This is the **ONLY GAS CANNEL** that will produce a **REALLY MERCHANTABLE COKE.** It can be delivered in parcels of one carload or more to any point in the United States or Canada. Cargo shipments of any size required can be made from **NEW YORK, PHILADELPHIA, BALTIMORE, or NEWPORT NEWS.** Samples will be sent and particulars of price, etc., forwarded upon application to above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Also, WEST FAIRMONT GAS COAL, of W. Va.

Analyses, prices, and all further information furnished on application to

Agency for U. S., Room 93, Nos. 2 & 4 Stone St., N.Y. City.

The Standard Oil Company,

REFINERS OF

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th Street, Phila. Pa

COKE CRUSHERS. GAS COALS. GAS COALS.

Newburgh Orrel Coal and Coke Co.

MINERS AND SHIPPERS OF

STEAM, SMITHING, AND GAS COALS,

Foundry and Crushed Coke.

Home Office, 33 S. Gay Street, Baltimore, Md.

CHAS. MACKALL, Gen. Mangr.

CHAS. W. HAYS, Agent, No. 1 Broadway, N. Y.

Shipping Wharves, Locust Point, Baltimore.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

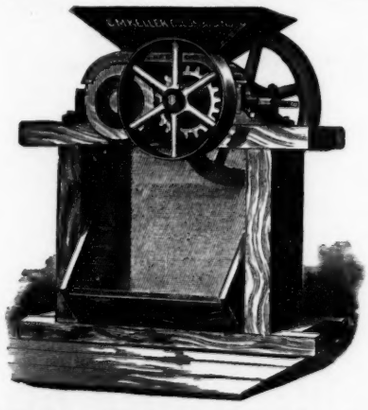
DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 225 E. German St., " "

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. { BANGS & HORTON, 60 Congress St., Boston.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

THE NEW HANDY BINDER.

This article may be described as elegant in appearance, strong, durable, and possessing many special qualities of its own. It allows the opening of the pages perfectly flat, whether one or several numbers are in the binder Any number can be taken out and replaced without disturbing the others. The papers are not mutilated for subsequent binding in permanent form. The binder is supplied with gilt side title, and is an ornament to any desk or reading table. The JOURNAL, filed in the Handy Binder, becomes a volume of great value, always convenient for instant reference. **Handy Binder, Postage paid, $1.00.**

A. M. CALLENDER & CO., 42 Pine St., N. Y.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City.

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The American Gas Engineer and Superintendent's Handbook.

By WILLIAM MOONEY.

Consisting of Rules, Reference Tables, and Original Matter Pertaining to the Manufacture, Manipulation, and Distribution of Illuminating Gas.

350 Pages, Full Gilt Morroco. Price, by Mail, $3.00.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

GAS METERS. GAS METERS. GAS METERS.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

Twelfth and Brown Streets Philadelphia Pa. No. 52 Dey Street, N. Y. City, and No. 75 North Clinton Street, Chicago, Ill.

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. CHICAGO, 197 Michigan Street.
NEW YORK, 766 Broadway. ST. LOUIS, 1115 Olive Street.
BOSTON, 4 Central Street. CINCINNATI, 206 Race Street.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

COMPOUND Condensing or Non-Condensing.
16 SIZES, 5 to 500 H. P.
Not yet equaled by any form of Engine for
HIGH FUEL DUTY AND SIMPLICITY.

STANDARD 13 Sizes in Stock. 5 to 250 H. P.
3000 in use in all parts of the Civilized World.

JUNIOR 6 Sizes in Stock, 5 to 50 H. P.
An Automatic Engine cheaper than a Slide Valve.
WELL BUILT. ECONOMICAL. RELIABLE.
Over 300 Sold the First Year.

All the above built strictly to Gauge with INTERCHANGEABLE PARTS.
REPAIRS CARRIED IN STOCK.
SEND FOR ILLUSTRATED CATALOGUES.

WESTINGHOUSE ENGINES
The Westinghouse Machine Co.
PITTSBURGH, PA. U.S.A.

SELLING DEPARTMENT IN THE UNITED STATES.

New York, Boston, Pittsburgh, Chicago,	17 Cortlandt St. Rathaway Building, Westinghouse Build'g, 156, 158 Lake St.	Westinghouse, Church, Kerr & Co.
Philadelphia,	608 Chestnut St. M. R. Muckle, Jr. & Co.	
St. Louis, Kansas City, Denver,	302, 304 Washington Av. 312 Union Avenue, 1330 Seventeenth St.	Fairbanks & Co.
Omaha,	1819 Capitol Avenue, F. C. Ayer.	
Pine Bluffs, Ark.		Geo. M. Dilley & Sons.
Salt Lake City, Butte, Mont.	259 S. Main St. 4 Granite St.	Utah & Montana Machinery Co.
San Francisco, Portland, Or.	21, 23 Fremont Street, Parke & Lacy Co. 33, 35 N. Front St. Parke & Lacy Mch. Co.	
Charlotte, N. C. Atlanta, Ga.	36 College St. 45 S. Prior St.	The D. A. Tompkins Co.
Dallas, Tex. Chattanooga, Tenn.,		Keating Imp. & Machine Co. C. E. James & Co.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Pres. WM. H. McFADDEN, Vice-Pres. (Phila.). WM. N. MILSTED, Gen. Supt. & Treas. (New York). WM. H. DOWN Sec

AMERICAN METER COMPANY.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES,
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter St., San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS, STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. S. L. JONES, Sec. F. V. MERRICK, Supt.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. 142 Chambers St., New York.
76 Dearborn St., Chicago, Ill.

WALDO BROS., Agents, 88 Water St., Boston.

MANUFACTURERS OF THE "SUN DIAL" GAS STOVES, FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Bray's Patent Gas Burners and Lanterns.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

G. B. EDWARDS, Mang'r, New York.
S. S. STRATTON, Mangr. Chicago.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (32 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

JOHN HILLEN,

250 & 252 Pearl St., Brooklyn, N. Y.

Manufacturer of IMPROVED

GAS METERS.

REPAIRING OF METERS (of all makers) a specialty. All defective working parts are replaced without extra charge. A guarantee is given with all work sent from this shop. Write for Price List.

GAS STOVES. GAS STOVES. GAS STOVES.

THE GOODWIN GAS STOVE AND METER CO.,

1012-18 Filbert St., Phila., 142 Chambers St., N. Y., 76 Dearborn St., Chicago.

Agents, WALDO BROTHERS, 88 Water Street, Boston.

WM. W. GOODWIN, Pres. and Treas.
W. B. MERRICK, Vice-Pres.
S. LEWIS JONES, Sec.

SAMUEL V. MERRICK, Supt.
G. B. EDWARDS, Mang'r, N. Y.
S. S. STRATTON, Mang'r, Chicago.

SOLE MANUFACTURERS OF THE

"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17¼ in. wide.	18 in. wide.	21 in. wide.	
	13 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9¼ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14¼ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

½ in. supply pipe should be used where the pressure is 1 in. or over.